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Centre's Path Breaking Pilot Schemes

Culture Fishery Status in Uttar Pradesh

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AUGUST 2001

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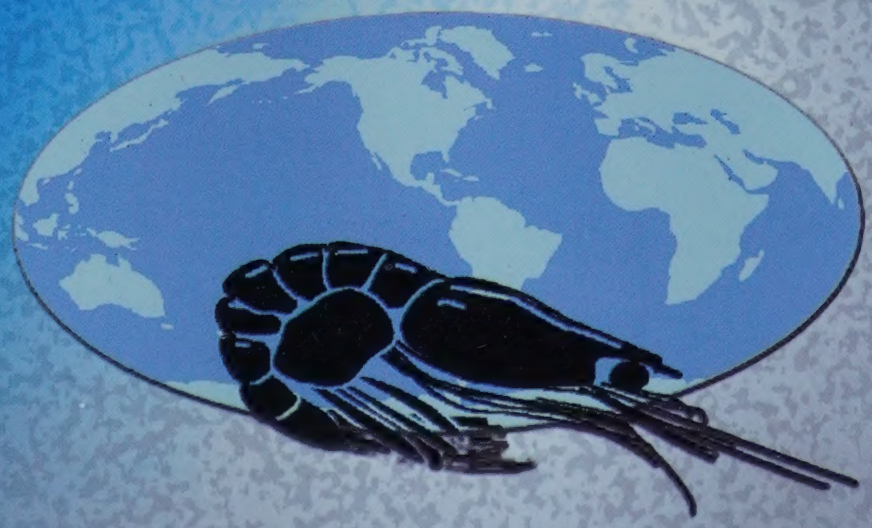

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Upgrades Capabilities ; Augments Output

NATIONAL FISHERIES JOURNAL OF INDIA

Vol. 21 No. 5
AUGUST 2001

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Goa coast is known for its rich marine fishery potential, and is a much sought after base for chartered/leased/Joint Venture trawlers earlier, and now for imported vessels registered under Indian flag. While the production increased from 17,000 t in 1963 to 94,547 t in 1997, in the subsequent years there has been a slide the production. Freshwater fish farming has also been gaining momentum in Goa.

P. Mohanta and S. Subramanayam tell us in this paper about the fisheries potential of Goan waters and also about the present status of fisheries development in the State. They have also listed out some of the development programmes already undertaken and proposed for the overall fisheries development in Goa 9

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Santir Aquatic has taken a path-breaking initiative of setting up a captive PCR Lab at its shrimp hatchery located on Kakinada Coast. Mr. Jose Cyriac, Chairman, MPEDA, inaugurated the Lab on 26 June 2001 49

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Thank you readers for your growing support

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LETTER

Sir,

I am writing this to clarify the present status of *Penaeus monodon* (Tiger shrimp) seed production and its culture in Australia.

It is not widely known that *Penaeus monodon* occurs in Australia as wild stock. The species was not introduced into our country. Our Government would not allow import of any livestock.

While it is true that Australian scientists are at work to produce disease-free domesticated stock of tiger shrimp in Australia for the past several years, commercial availability of disease-free domesticated tiger shrimp stocks would take time. Spawners of the shrimp collected from the wild are available from March to December. Prices vary from Aus $ 80 - 200 each length range being 22 to 30 cm. Long distance transport of spawners could be difficult. Regarding area under tiger shrimp culture, at present we have farms under 500 ha in all at present. The average production per ha for most of the farms is 5 - 10 t/ha.

There is no whitespot disease afflicting our wild spawners. Rigorous tests have been conducted to locate such occurrence but invariably all spawners have so far been found to be free from any infection.

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C.I.F.T bags Best I.C.A.R. Institution Award

The Central Institute of Fisheries Technology (C.I.F.T), Cochin, functioning under the Indian Council of Agricultural Research (I.C.A.R) is the only national fisheries research centre in the country where research in all disciplines relating to fishing and fish processing is undertaken. This institute, with a track record of five decades of dedicated work, has been working on various aspects of harvest and post harvest technologies in fisheries sector along the East and West coasts of India. It has Research Centres functioning at Visakhapatnam (Andhra Pradesh), Veraval (Gujarat), Burla (Orissa), Mumbai (Maharashtra), Calicut (Kerala) and Hoshangabad (Madhya Pradesh).

The Institute has been conferred with 'SARDAR PATEL OUTSTANDING I.C.A.R. INSTITUTION AWARD' for the year 2000.

The major focus of research during the year was development of responsible fish harvesting techniques and viable post harvest methods. The major contributions to the fishery industry include, launching of 15.5 m fuel efficient deep sea fishing vessel designed and constructed at C.I.F.T, finalizing the design of a 5.69 m FRP canoe for use of the traditional fishers, popularization of V-form steel otterboards of C.I.F.T design, development of a modified HACCP (Hazard Analysis of Critical Control Points) plan and quality standards for raw frozen fish/shell fish export from India to European Union countries in order to overcome the problem of rejection on account of presence of pathogens, development of methods of production of value-added ready-to-use products such as fish curry in retortable pouches with minimum shelf life of 6 months at room temperature, setting up of a scaled up production unit for the production of Poly Unsaturated Fatty acid (PUFA), finalizing the design of a pilot plant for production of absorbable surgical sutures and setting up of an all women small scale fish processing unit for the SC/ST Service Cooperative Society at Chellanam village in Cochin.

Good scope for ornamental fish rearing in Kerala seen

There is good potential for rearing ornamental fish in Kerala. The farmers in the State can undertake ornamental fish farming with comparatively small investment, and get very good returns as there are sustainable markets both inside and outside the country, according to Mr.A.V. Mathew, of Kerala Agricultural University.

On a global basis, India ranks one among the top few countries with maximum ornamental fish reserves. Andaman-Nicobar islands, Lakshadweep islands, the south-east and south-west coastal areas are all rich in ornamental marine varieties.

Of the 600 varieties found in and around lakshadweep islands, 300 belong to ornamental category. In Kerala, coastal areas from Kochi to Vizhinjam are the rich sources of several attractive species of ornamental category.

According to a study conducted by the World Trade Organisation (WTO), the global ornamental fish market is worth about US$ 4500 million. Asian countries including Philippines, Singapore, Indonesia, Mali, Hongkong and Thailand together have 60 per cent share in the world market. However, exports from India are just marginal at present.

In Kerala, technologies could be developed for the large-scale production of ornamental fish varieties such as angel fish, gold fish, koi carp and pearl gourami. A veil-tail variety of angel fish with good market prospects had been developed through selective breeding by Kerala Agricultural University. Most farmers now involved in ornamental fish farming in the State need training in scientific rearing, it is stated.

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CENTRAL MARINE FISHERIES TECHNOLOGICAL RESEARCH INSTITUTE REGIONAL CENTRE MANGALORE 12/9/2001

FISHING CHIMES

SHRIMP FAMINE STALKS UPPER EAST COAST

A paradoxical combination of two factors poised against the economics of operation of shrimp boats are presently crippling the shrimp sector of the upper east coast. One of these is the unprecedented drop in capture shrimp landings at the various centres along the coast this season. The other factor that aggravated the situation was the slide in global shrimp prices, particularly in Japan and USA. The net effect of these two factors is that shrimping vessels, particularly those operating from harbours of A.P. are forced to confine themselves to harbours and other anchorages in the zone, with all consequential repercussions such as mounting costs, job insecurity etc. This development has brought all associated capture shrimp fishery activities to a grinding halt.

The vessels that operate from various centres of upper east coast, as elsewhere along the coastline, are dependent on the shrimp component of their catches for economic viability. This component has come down to such a low level that they are unable to recover even the cost of diesel oil. So much so, all the fishing ports and landing points are jam-packed with anchored boats.

In States like Maharashtra and Karnataka , it is learnt that there is exemption from payment of sales tax and also excise duty. In the States of the east coast no such exemption is given. The granting of similar exemption in the coastal states of the east coast too would provide some relief to the boat operators. Adding to woes of the operators of the industry is the abnormal increase in berthing charges at Visakhapatnam harbour from Rs.230/- to Rs.2069/- per boat per month. The long standing demand of the Mechanised boat and other Associations to prevent vessels of foreign origin from operating in sandheads and other areas of upper east coast and to subsidise diesel oil prices, in view of the mounting operational costs went unheaded by the government. Another grievance is that wild shrimp seed is exploited unchecked by several for supply to farmers. Boat operators feel that this has a depleting effect on shrimp fishery. For this reason they want this activity to be banned. Under the weight of these problems, which remain unheaded by the authorities , the members of the A.P. mechanised boat operators association have taken to staging an indefinite dharna at Visakhapatnam to draw the attention of the government for the redressel of their grievances.

While boats could stop fishing to cut down further losses, the culture fishery sector had no such easy option. Postponement of harvesting, hoping for an improvement in shrimp price structure, ignoring the readiness of the crop for harvesting, would give rise to added expenditure on feed and other items without commensurating benefits. The growth of shrimps, if so postponed will be just marginal and not adequate to offset the additional costs. Consequently, the farmers had no alternative other than harvesting. Whereas in the last season they could secure a return of around Rs.500/- per kg of shrimp harvested, now the exporters could offer only less than half of this, because of the declining global market for shrimp. This is so because, unfortunately, exporters are not in a position to hold on to the stocks for long, for want of adequate storage capacity at shore plants for the purpose.

In general, marine fish do not command a lucrative price in the States of West Bengal, Orissa and in Andhra Pradesh. For this reason, the quantum of shrimp catches in the landings of the boats alone influence the economics of operations. At the best, returns from sale of fish catches form marginal earnings to the operators and these are not of much consequence to them. For this reason, the per unit earnings of boats in these States have tumbled down to a hopeless level, forcing most of the owners to close down operations. The accumulated dues on cost of diesel oil and port dues are the burden that the operators have to discharge now. In contrast, in the State of Tamil Nadu, prime fish component of the catches fetch an attractive price in Chennai city and this appears to make a crucial difference between the level of earnings of boats that operate in the upper and lower east coasts. So much so, despite poor shrimp catches, the boats of Tamil nadu and southern A.P. coastal zone are believed have been able to reach break-even level.

Various contributory causes are attributed to the present depressing situation. One is that Thai vessels are stated to be dominating the grounds of the West Bengal and Orissa coasts which the Indian boats are unable to counter. It is alleged by Vessel Owners Associations that coast guard does not effectively intervene despite complaints and they could not do anything by themselves as the foreign vessels are stated to be well equipped with grenades and arms to protect themselves. Ironically, these vessels fly Indian flag as they are technically Indian owned but are stated to be totally controlled by Thai owners and Thai crew and operated with Paradeep as the base. Another aspect mentioned is that the number of bottom-set gill net units that had been put into operation off West

Bengal coast has led to poor trawl net operational results. It is difficult to say how far this can be true. In any case, there is a general consensus that the closed season as experimented upon recently in all the four coastal states on the east coast is no solution for conserving annual crops like those of shrimps. A further view expressed is that, for complex biological reasons in a three or five year cycle shrimp fishery suffers a setback. This had happened before, although not so severe as in this season. It is felt that the situation became so bad not so much for other reasons but because of operations of imported vessels with Thai crew, which are stated to be conducted in relays by batches of vessels round the year. The allegation is that different sets of vessels but with same marking and documents manage to be in the grounds on a relay system, thereby operating relentlessly and without break, with no let or hindrance.

Export prices crashed from US 18/kg for 16/20 count in June last year for head-on black tiger to less that US $10/- per kg by July end this year, according to the President of the Association of Indian Fishery Industries. This is because of flagging consumption of shrimps in Japan and a trend towards lower prices in U.S.A, it is stated. The latest position however is that has been a marginal increase in export prices now.

Charles Woodhouse, Principal in the Philadelphia Law firm of Woodhouse Shanahan Hart PC and who is on the Board of Directors of Choice Canning Co, Inc, one of India's largest shrimp exporters, in his regular column entitled "Farm Shrimp News" in Fish Farming International, wrote as follows in July 2001 issue of the tabloid, under the caption "Market bottoms at prices not seen in five years":

"Long-time readers will remember my oft-quoted maxim from The Old Man of the Sea - 'You'll run out of money before they run out of shrimp'. This year should teach anyone in the trade that there are plenty of shrimp in the world.

Yes,there is all this silly talk about diseases and viruses - but the truth is that the world's shrimp farms had a record year in 2000 and there are still lots of shrimp left to eat. Enough shrimp to destroy traders who began the year with major positions.

The bellweather Ecuador 41/50 shell-on tail now sells for $3.50 a pound in New York. Those of us who did not commit suicide in 1995 after the market dropped from $5.00 to $3.50 have now seen the market drop from $6.00 to $3.50!

There is also some strange stuff going on in the market. South American 26/30 tails are defying gravity at $7.40, while I can buy a perfectly sound Thailand 26/30 tail for $5.00 - difficult to explain!

This year promises to be another record one for US shrimp imports. Through March, they were 18% above comparable 2000 levels at 155 million pounds (70,308 tonnes).

As usual, Thailand is the number one supplier to the US, with India now in second place instead of Ecuador. India has also moved into number two position as a supplier to Japan, replacing, Indonesia - with Thailand, of course, top as always.

In Japan, unlike the US, major importers have been cautiously looking for the bottom before making fall (autumn) season commitments with suppliers. Japanese imports were only 66,000 tonnes through April, which is even with the comparable 2000 level despite much lower prices.

Future contracts : An interesting story comes out of Japan, with the KANEX (Kansai Commodities Exchange) considering and rejecting the possibility of introducing a Frozen Shrimp Futures Contract.

As many of our readers will already know, a commodities Futures Contract is a financial 'derivative' instrument which serves as a proxy for a physical transaction which is called a Forward Contract.

In the 'real world' commodities producers and users enter into Forward Contracts for their physical sale and purchase of actual products. They, as well as speculators, then 'hedge' physical positions (or gamble) by trading Futures Contracts.

These contracts are finally settled at maturity without physical delivery. Yes, you could theoretically take delivery, but this seldom happens. Anyone foolish enough to do this with shrimp would get a nasty surprise when 'generic' shrimp was delivered.

Apparently the KANEX executives and traders studied shrimp and determined that, as we all know, shrimp are not a fungible commodity.

For shrimp, value is determined by species, freshness, processing, grading, brand identity, and it takes a lifetime of experience to understand why one case of shrimp can be sold anytime at a profit and another will sit in the warehouse until you have to dump it.

The Minneapolis Grain Exchange (MGEX) still continues its listing of White Shrimp contracts, but it has never been able to develop significant volume. A trip to the MGEX website reveals that "there is no open interest in any contract months" for either listing.

Always remember, the Old Man of the Sea says: 'An expert in the shrimp business is someone with more than 20 years' or less than one year's experience.' It seems that, before repeating this mistake, the KANEX executives were smart enough to find one of the old experts rather than a young one!"

The present alarming shrimp fishing situation along upper east coast has rendered capture shrimp business uneconomical to the exporters too, because of relentlessly falling export prices, and with pressures from producers on the exporters to buy their produce, however low it is, at higher prices. This pressure is compounded with the availability of cultured tiger shrimp in abundance with farmers, who have no option other than selling their produce to the exporters.

It is believed that export prices would gradually pick up from now on and this throws a ray of hope that the situation may improve. With cultured shrimp harvesting on the east

coast having almost come to a close, the exporters, if they have to buy, have to depend on capture shrimp only from now onwords, it is felt. The outlook, however, is vague.

Two long term solutions to guard against such situations are put forth. One is to take immediate steps though an appropriate project to equip the boats for diversified fishing in farther waters. The other is to introduce a system of declaring fish famines officially, as they do occur now and then, to enable the government concerned to assist fishermen to tide over such famines. A permanent Fish Famine Fund can be set up with a corpus provided by the government and fishing vessel owners making contributions, as stipulated, to the Fund on a continuing basis during fishing seasons. The level of contributions by fishing units, and the procedure for collections, have to be determined by the government and a recognised Association can be entrusted with the job. Government may make matching contributions on an annual basis based on audited accounts to enable the Association concerned to distribute these funds among the registered beneficieries to tide over financial crises as per the guidelines laid down, as and when fish famines are declared. In Maharashtra and probably in one or two other states a system of declaring fish famines is understood to be prevalent. Keeping all aspects in view, the Government of India can recommend to the coastal governments to introduce the system of declaring fish famines. In this context the states can be advised on the criteria to be kept in view for declaring a fish famine. In the same way as the fishermen's accident insurance schemes, the government of India could also consider assisting coastal state governments with a measure of matching contributions. The other ancillary lines of relief to cover day-to-day economic problems of fishermen are : 1) Confine operations of recently imported fishing vessels to the zone beyond territorial waters and that too only with all-Indian crew and not permitting any foreign crew to work on the vessels, 2) Organising training programmes to Indian crew for working on imported lonliners, 3) To stop import of trawlers, 4) Bringing berthing charges at Visakhapatnam harbour at par with other harbours, and 5) Regarding the demand for ban on wild shrimp seed exploitation, it is stated that the ban is already there and steps are understood to have been taken for implementation but the problem is one of effective enforcement. Here it has to be mentioned that the operators who want wild shrimp seed capture banned, take special interest in catching gravids for sale to hatcheries. Unwilling to give up this remunerative practice probably for the reason that they will be exploited in any case for export, they seek a ban on wild seed capture. These two stands are contradictory to a large extent. They observe a closed season to protect stocks and the same principle should be applicable to avoid catching of gravids too. It appears that what the operators should ask the government is to undertake development of strains of domesticated tiger shrimp brooders for supply to hatcheries and for a stipulation that hatcheries should release one round of post larvae produced by them into the sea, until such time as domesticated brooders are developed for supply to hatcheries.

Decline in Karnataka fish output

The total fish production as well as the quantum of 'high-value species' in Karnataka has begun to decline. The State, which used to contribute around 10 percent of the country's total production in the 1970s, is now contributing about 5-6 per cent, according to a study conducted by the Department of Fisheries Economics of the College of Fisheries, Mangalore.

The study, titled 'Socio-economic impact of changing fish utilisation patterns in Karnataka', was conducted to "provide an overview of the changes that have occurred in fish supplies and utilisation on the one hand and the socio-economic impact of such changes" on the other. The study particularly looks into policy changes and their impact in the post-reforms period in the context of trying to estimate the 'social costs' of economic reforms.

According to Dr.Ramachandra Bhatta of the Department of Fisheries Economics of the college, the total fish production, which increased at the rate of 2.65 per cent and 5.95 per cent during the 1970s and 1980s respectively showed a negative trend of 8.7 per cent in the 1990s. During the same period, however, the total number of fishing boats increased from 2,185 in 1980-81 to 25,610 in 1998-99. Further, the concentration of mechanised fishing boats in some areas had resulted in reduced catch per unit of fishing effort, it is stated.

Also, during the post-mechanisation period the seasonality in fish production is stated to have declined. While during 1970s only 7.42 per cent of the total fish was harvested during the monsoon period (July to September), this figure increased to 19 per cent during the 1990s indicating the ineffectuality of closed season regulations. Karnataka, which was a net exporter of fish to neighbouring States during the 1980s was now importing fish from Goa and Maharashtra, according to the study.

At the same time, the contribution of fisheries to GDP almost doubled from Rs. 3,702 lakhs in 1980-81 to Rs. 6,666 lakhs in 1996-97 (at 1980-81 prices). At current prices, the figure is estimated to have reached Rs.39,575 lakhs. Foreign exchange earnings had also increased from Rs.11.43 crores in 1980 to Rs.114 crores in 1998, only 2.61 per cent of the total earnings from marine exports of the country.

However, the post-mechanisation period had also seen a decline in employment generation. A fish processing (drying) unit, which used to employ 10-15 women workers during the early 1990s, now employs only 1-2 as and when the need arises.

According to the study, there is ample evidence to show that the common pool of resources in coastal Karnataka, which provides a substantial part of the income of poor fishing communities is being degraded making such communities more vulnerable than others to the adverse impact of economic reforms.

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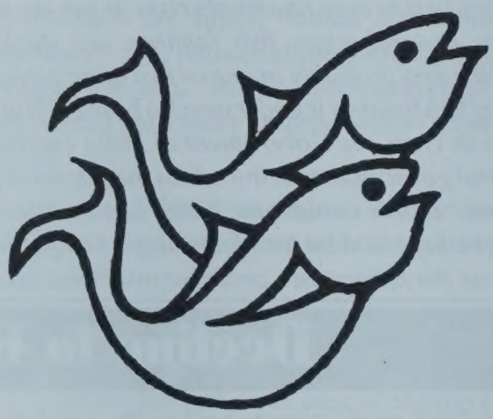

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Resource Potential and Fisheries Development in Goa

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Goa, situated at 14° 49' and 15° 52' North Lat and 73° 38' and 74° 24' East Long has a land area of 3701 km², coastline of 105 km, continental shelf of about 10 million ha and an actively fished area of about 20,000 sq.km. The population of Goa is around 15 lakhs with a high literacy rate. Fish forms the chief component of the diet for 95 % of the Goan population. Fishing is one of the important economic activities of the State contributing to 3.0 % of the net domestic product of the State.

Inland Fisheries of Goa

a) *Rivers, estuaries, mangrove, brackishwater and Khazan lands*: The total length of riverine system in the form of river branches, canals, creeks and tributaries is about 555 km, of which 340 km of riverine waterways are navigable. The nine rivers flowing in Goa are, Terekhol, Chapora, Baga, Mandovi, Zuari, Sal, Saleri, Talpona and Galjibag, of which Mandovi and Zuari are the major ones (Subramanian, 1994).

The total estuarine area in Goa is 13,157 ha. Mandovi and Zuari are the two major estuaries (known as lifelines of Goa) which are interconnected by Cumberjua canal 14 and 11 km away from the mouth of the respective estuaries. Both the estuaries open into the sea at Dona Paula beach. Stratification of upper and subsurface layer takes place during South-West monsoon (June-September). In this period of the year more or less homogeneous conditions prevail (Achuntankutty, 2000). The salinity and tidal effects are very much pronounced except in June-September of the year when there is a heavy influx of freshwater into the sea. Mandovi estuary is five km wide at the mouth region, whereas Zuari is about seven km wide. The estuarine bed of the Mandovi river is mostly sandy or muddy whereas Zuari is mostly rocky (Subramanian, 1994). Salinity during monsoon season may go upto 4 psu at the mouth region and 0.1 psu at the upper reaches of the Mandovi estuary, whereas at the mouth of Zuari estuary it may remain quite high (12 psu approximately), but may decline upto 0.1 psu at the upper stream region. Subramanian (1994) reported that the estuarine sector of Goa is divided into 3 zones based on the salinity gradient, substratum and wave action. These are (1) Euryhaline zone towards the river mouth with high salinity (30-35 ppt), strong wave action and rocky or sandy substratum; (2) Polyhaline zone with moderate salinity (18-30 ppt), less wave action, sandy or clayey substratum and mangrove vegetation and (3) Mesohaline zone in the interior region with low salinity (5 to 18 ppt) and having silty clay substratum.

Goa is having about 2,000 ha of mangrove area, which is associated with riverine estuaries especially Mandovi, Zuari and Cumberjua canal. Many mud flats are also formed on either side of the river canal.

Brackishwater areas of Goa are estimated at about 3,500 ha. About 80 ha of brackishwater area in the State has been brought under developed scientific shrimp culture with subsidy support from BFDA. Another 19 ha of area (about) with subsidy and support from MPEDA has also been similarly developed. About 60 percent of the marshy area i.e., 2,000 ha is estimated to be fit for aquaculture. The pilot shrimp seed hatchery project operated since 1992 under BFDA is catering to the seed needs of supply to the shrimp farmers of the region.

There are about 18,500 ha of Khazan lands in Goa. Certain Khazan areas are situated very close to estuary or its tributaries are demarcated for setting up a permanent fish farm. This area is flooded with saline water, and receives wild stock of all varieties of fish and shrimp during May-June period and harvesting of marketable size fish is a continuous process (Dhandar and Subramanian, 1998). Shrimps, mullets, lady fish, pearlspot, catfish, *Ambassis* species, estuarine crabs and molluscs form the major fisheries from the Khazan lands of which shrimps contribute the bulk comprising mostly *Metapenaeus dobsoni*, *Metapenaeus monoceros* and *Penaeus merguensis* (Subramanian, 1994). Salinity of Khazan lands ranges less then 20 ppt until September, less than 30 ppt upto February and between 30-35 ppt from March to May. The tidal flactuation is around 1.5 m and many saline lands have a water column of at least 0.5 m even during the severest summer (Dhandar and Subramanian, 1998).

(b) *Freshwater lakes, reservoirs, canals and other impoundments*: The important lakes in Goa are Mayem, Curtorim, Benaulim, Carambolim,Chimbel and Cacoda, besides 100 ha of seasonal and perennial ponds and *bhandaras*. There are about 400 storage tanks and 1500 minor irrigation wells in Goa. At present there about 3,250 ha of reservoir area under two irrigation projects namely Salauli (2,964 ha and Anjunem (253 ha). There are two major canals at Candeapar and Paroda. About 200 ha of old and discarded mine reject pits are available and these which are having perennial water source with a water depth of 5 to 30 m and these can be considered for fishery operation (Subramanian, 1994).

Inland Fishes of Goa

The major inland fishes of Goa comprise mullets, pearlspot, lady fish, *Ambassis* species, croakers, carangids, betki, snappers, anchovies, Indian salmon etc. The crustaceans consist of shrimps/prawns, estuarine crab, and molluscs consist of green mussel, oyster and clams.

***Different fish catching methods in inland waters of Goa*:** The estuarine and the riverine fishing activities are carried out throughout the year in Goa. The estuarine fishing is sparsely done during the monsoon and is restricted mainly to

stake-net operations, and net operated by sluice gate during spring tide. The types of fishing gear operated in the estuaries consist of gill nets, barrier nets, stake nets, cast nets, traps, hook and line, *futani* net, *pantiveni* and small/medium size seine nets.

Freshwater fish farming: This activity in Goa is gradually gaining momentum, despite the fact that most of the people in the State traditionally prefer marine fish. Freshwater fish farming in Goa is now confined to around 100 ha. Freshwater fish farmers in the southern area of the State who culture major carps in their farms have found the activity remunerative. This indicates that freshwater fish farming is gradually gaining in popularity. A freshwater fish seed hatchery (carp) has already been set up at Anjunem, Keri, and Goa, where around 15 lakhs of seed of carps (rohu and catla) were produced during 1998-1999 and 1999-2000.

Marine fisheries

The marine fish production which was around 17,000 t until 1963 has steadily increased to 94,547 t in 1997 which included 3200 t caught from estuaries, creeks and tide fed traditional farms. The growth rate of marine fish production over the years is given below :

Year	Total fish production (tonnes)	Growth rate (%)
1963	17,000	
1970	36,616	115.4
1980	26,715	- 19
1990	56,225	119
1995	85,418	52
1997	94,547	10.7
1998	70,710	-17
1999	63,440	-10

The State has 20,000 fishermen distributed over 3,380 households, in coastal fishing villages and in areas bordering the seven estuaries, creeks and other tributaries. There are 61 fishing villages and 50 fish landing centres. About 25 % of the fish and seafood products is contributed by traditional fishermen. Although Pernem, Bardez, Tiswadi, Momugao, Salcete and Canacona are fish catching areas along the coast, about 75 % of the total fish catch takes place only in three talukas namely Marmugao, Salcete and Bardez. There are about 2,000 numbers of canoes/country crafts registered with the Fisheries Department engaged in gill net fishing, exploiting both rich demersal and pelagic fishes of inland and marine waters. The Government has encourged mechanisation of country craft by ouboard/inboard motors by providing financial assistance in the form of subsidy to the tune of 10,000/- per boat under centrally sponsored scheme on 50 : 50 basis (Verekar, 2000). The number of mechanised boats increased from 10 in 1965 to 100 in 1970, to 180 in 1970-1980, to around 600 by 1985 and by end 1995 the number crossed 1,000 mark. By 1998 the number increased to 2,200. The marine fish potential of waters off Goa are estimated to be 1.08 lakh, against which the exploitation was upto 94,547 tonnes (1997). The maximum sustainable yield (MSY) of the actively fished zone is 71,000 tonnes, while the maximum harvestable yield is placed at 60,000 tonnes. Thus, the MSY has been exceeded, causing concern. The catch per unit effort (CPUE) is reduced due to the large number of mechanised fishing boats in operation. This has resulted in diminishing returns. A ban on fishing activities, particularly during South - West monsoon period was introduced in Goa initially for 90 days but subsequently reduced to 54 days as most of the economic varieties of fishes breed during this period.

The varieties found in the marine catch in Goan waters are mullets, milk fish, lady fish, sea bass, cat fish, croakers, carangids, snappers, groupers, anchovies, seer fishes, pomfret, ribbon fish, squid, mackerel, oil sardine, lesser sardine, Indian salmon, flat fish, shark, ray, shrimp lobster etc. Around 41 varieties of marine fishes are found in Goa. Prominent among them are sardine and mackerel which constitute almost 46 % of the marine catch (Verekar, 2000). Mackerel (locally called as *Bangda*) is the most preferred fish of the people of Goa. The other fishes of preference are seer fish (locally called as king fish), pomfret and also sardines (called as *Tarle*). The commercial fish varieties like squid, cuttle fish, shrimps, breams, ribbon fish etc. contribute to 58 % of the total exported marine products. From July to August heavy catch of solar shrimp (*Metapenaeus dobsoni*) takes place. Egg-laden mackerels and sardines and juveniles of other species like pomfret are also harvested. Good quality species like seer fish, pomfret, ghol, squids, Indian halibut, jew fishes, croakers, cat fishes and tiger shrimp, besides many variety of fishes are also harvested at 30 to 50 m depth. Deeper waters i.e., 60 to 120 m depth yield reef cods, sea breams and cuttle fishes.

With regard to shrimp, there are about 20 varieties of them recorded in Goan water (Achutankutty, 2000). These are *Penaeus monodon, Penaeus indicus, Penaeus merguensis, Penaeus semisulcatus, Penaeus japonicus, Penaeus canaliculatus, Metapenaeus dobsoni, Metapenaeus monoceros, Metapenaeus affinis, Metapenaeus moyebi, Metapenaeus ensis, Metapeneus brevicornis, Metapenaeus alcocki, Metapenaeus mogiensis, Trachypenaeus curvirostris, Parapenaeopsis stylifera, Parapenaeopsis cornuta, Parapenaeopsis hardwickii, Parapenaeopsis scultilis, Parapenaeopsis acclivirostris.*

Shrimp larval resources

Shrimp larvae occur in the coastal waters (off Aguda) and estuaries (Mandovi and Zuari) in varying percentages from December to August. About 52.5 % of the total shrimp larvae in the coastal waters occurs during monsoon season and 37.9 % during post monsoon season. However, in estuaries, 85.6% of them in Mandovi and 56% of them in Zuari have been observed during post-monsoon season and the occurrence in pre-monsoon and monsoon periods is comparatively less (Achuntankutty, 2000, based on two years data).

There are about 10 fisheries cooperative societies. Their formation in stages started way back in 1964. However, now only one society, Akhil Gomantak Harakari Sahakari Saunstha Ltd, continues to function. The other nine societies are either dormant or non-functioning. There is already the facility of five jetties set up by the Fisheries Department for fish landing and for vessel berthing. Another two jetties are under construction. The department has already con-

structed ramps and auction- cum-net mending sheds in 25 places all along the Goa coast. Some of the programmes already undertaken or proposed for the overall development of fisheries in Goa are as follows (Verekar, 2000) :

(1) A 300 meter long jetty is proposed at Cutbona landing centre which is expected to caters to the need of about 350 boats operating in that region. A new jetty of 75 m length is being constructed at Vasco near Vasco Bay through Marmugao Port Trust.

(2) There is no fish meal plant at present in the State. Therefore, a fish meal plant with adequate facilities was proposed to be set up during 9th Five Year Plan for production of fish meal by using low-valued fishes. As the plant has not yet been set up the catches presently going waste.

(3) Value-added products like fish sausages, fish pickles, different canned products, smoked products, cutlet and many other ready-to-eat products are proposed for production. Government has also a proposal to encourage the setting up of a Fish Processing Unit by providing necessary subsidies and other incentives including training.

(4) For hull and other repair works related to mechanised vessels, facilities for beach landing are proposed. Some sites have been already identified for the purpose.

(5) Encouraging integrated coastal aquaculture practices.

(6) Demonstration-cum-training in brackishwater fish and shrimp farming.

(7) Financial assistance for the construction of wooden and FRP crafts.

(8) Prohibition of fishing within the area of 5 km from the sea coast of Goa throughout the year.

(9) Complete ban on fishing during the monsoon period from 1st June to 31st July of the year.

(10)Regulation of mesh size of fishing nets at 20 mm for shrimp nets and above 24 mm for nets used for catching fish.

(11)Prohibition of catching of juvenlies of economic varieties of fishes like mackerel, sardine, seer fish, pomfret etc.

(12) Prohibition of mechanised fishing in inland waters.

(13)Not to allow indiscriminate increase in the size of the fleet by fixing quota of only five new trawlers above 14 m per year which are designed for fishing in territorial waters and beyond.

(14)Construction of smaller trawlers equipped with three cylinder engines to be totally discouraged.

(15)Legislation to regulate fishing and providing protection to reserved fishing area in Goa to be promulgated.

(16)Organised collection of inland fisheries statistics to be undertaken.

(17)Training is proposed to be imparted to fishermen, fish farmers and unemployed youth to equip them with knowledge of different aspects of fisheries.

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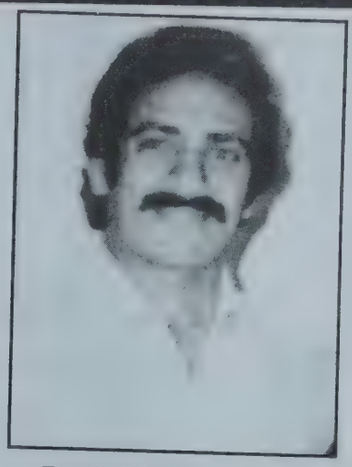


Dr. V.K. Unnithan

Udaipur fisheries fraternity deeply mourn the untimely demise of Dr. V.K. Unnithan, Principal Scientist, National Bureau of fish Genetic Resources, Lucknow on 26 April 2001at an age of 50.

Dr. Unnithan was the first Ph D. of the Department of Limnology and Fisheries of the Udaipur University, presently Maharana Pratap University of Agriculture and Technology. His work on the raciation of *Labeo gonius* in Udaipur river systems was a contribution to our knowledge of fish population dynamics of Rajasthan waters.

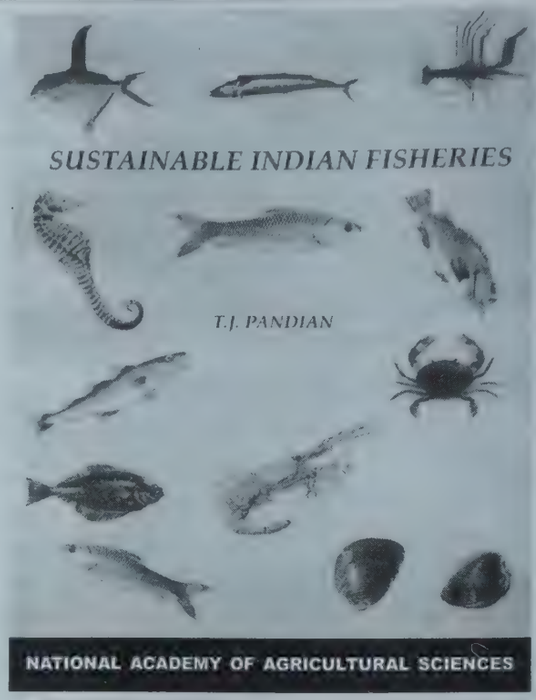
Besides being a student of fisheries science, Dr. Unnithan was an environmentalist. He was the President of the Youth wing of the National Environmental Association and Asian Regional Coordinator of the International Youth Federation for Environmental studies and Conservation, Denmark.

After his Ph.D., Dr. Unnithan was selected in A.R.S and served the Central Inland Capture Fisheries Research Institute, Barrackpore. Later, he was in charge of Lacustrine Fisheries Unit at Coimbatore and Allapuza in Kerala where he worked on the infestation of reservoirs with Tilapia.

Recently, he was elevated to the post of Principal Scientist and posted to lead the fishery biology unit of the Bureau of Fish Genetic Resources. Dr. Unnithan received his post-doctoral training in Soloman islands in Australia where he specialized in Fish population dynamics.

Fishing Chimes offers our heartfelt condolences to the bereaved family and pray Almighty to give strength to his family bear the loss. Dr. Unnithan is survived by his wife and two children.

SUSTAINABLE INDIAN FISHERIES



Editor: T.J. PANDIAN

Publisher: National Academy of Agricultural Sciences, New Delhi
Year: 2001, Pages 327, Size: 21.5 x 27.5 cm
Price: Rs. 300/-; besides Rs. 50/- for postal/delivery charges

This book is an outcome of an one-day discussion held by leading Indian fisheries experts, who have identified the components for a relevant and balanced fisheries policy for India. It points out both strong and weak facets of our fisheries and aquaculture enterprise. Each of the experts was invited to comprehensively contribute a chapter in his/her area of expertise. The MSs were subjected to peer-review; the revised MSs were presented and discussed. Hence the book represents a comprehensive account of those invited contributions.

The book includes 16 topics classified under sections: Capture Fisheries, Aquaculture, Post-Harvest and Education and Publication in Fisheries. It commences with an introductory (N.B. Nair) and thought-provoking (M. Sakthivel) chapters. Capture fisheries includes titles on coastal (E. Vivekanandan), freshwater (V.V. Sugunan & M. Sinha) and deep-sea fishing (S. Somvanshi). The Aquaculture section includes status reports on freshwater (S. Ayyappan & J.K. Jena) and brackishwater (G.R.M. Rao & P. Ravichandran) aquaculture of India. Chapters on feed production (T.J. Pandian *et al.*), diseases of shrimp (I. Karunasagar & I. Karunasagar) and diversification of aquaculture (M.N. Kutty) will be of immense help to aquaculturists. Contributions on the need for conservation of germplasm resources (A.G. Ponniah) and legal framework (M. Sakthivel) are also included. The Post-harvest section comprises chapters on transport and handling of fish (K.K. Balachandran *et al.*), fish processing (B.A. Shamasundar) and fish for nutritional security (Ghafoorunissa). Titles on education and publication are contributed by S.A.H. Abidi and S. Arunachalam and their colleagues, respectively. It also includes a special strategic chapter on "A Prelude for Fisheries Policy of India".

Prof. M.S. Swaminathan, Dr. R.S. Paroda and Prof. V.L. Chopra have given Foreword for the book and recommended that "the book will be useful for post-graduate students, research scholars, scientists, policy makers, entrepreneurs, aquaculturists and fish farmers".

The book is sold on non-profit basis. Educational institutions, scientists and students receive 15 % discount. For ordering 10 copies one complimentary copy will be free, over and above the 15 % discount.

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Shrimp Hatchery Operators and Farmers Meet

Kakinada, A.P: 26 June 2001

A Shrimp Hatchery Operators and Shrimp Farmers Meet was organized by the MPEDA, Regional Centre (Aquaculture), Vijayawada at Jaya Residency, Kakinada, A.P on 26 June 2001. Around 60 shrimp hatchery operators and farmers from East Godavari District and farmers' representatives from Krishna, Prakasam and Nellore Districts participated.

Mr. B. Vishnu Bhat, Deputy Director (Aqua), Vijayawada, setting the tone of the meet, referred to the problem of disease outbreak and others faced by shrimp aquaculture sector. He told the participants that adoption of eco-friendly practices with a code of conduct by the shrimp hatchery and shrimp farm enterprises is the only way contain disease outbreaks.

Mr. K.Jose Cyriac, Chairman, MPEDA, addressed the gathering. He said that any growing sector would face problems and aquaculture sector was no exception. He told the participants that MPEDA had introduced a scheme for voluntary registration of shrimp hatcheries. Such of the registered hatcheries following the minimum standards laid down and code of practices stipulated would be given financial assistance in the form of subsidy to the extent of 50% of the cost of PCR lab subject to a maximum of Rs. 5 lakhs. He promised that all the problems faced by the hatcheries and farmers would be sorted out to for the cause of successful and sustainable aquaculture. He was confident that 10 to 15 hatchery operators would lead the way, to start with, for setting up PCR labs in order to produce quality seeds, to be followed by the others. He highlighted the responsibility of the exporters to ensure the quality of the product even after it reached the consumer. In the same way as exporters had been given the privilege of self certification, such a voluntary system would be made applicable to hatchery operators as well. He exhorted them to come forward voluntarily for registering their hatcheries with MPEDA, adding that MPEDA was ready to consider extending the benefits of the scheme to all the hatcheries that would come forward, even upto around 50 of them initially. He made the focal observation that the hatchery operators should produce quality seeds by adopting the code of practices as stipulated, while emphasing the negative impact unregistered hatcheries would have to face, once MPEDA advertised the names of registered hatcheries. He said that in Thailand the hatchery operators were giving a 30-day guarantee for the seed supplied by them to such of the farmers who had adopted closed recirculating system. He hoped that Indian shrimp hatchery operators too would scale to the same level of confidence.

The Chairman told the participants about SHRIMP 2001, the fourth world conference on shrimp industry which would be held from 27 to 29 September 2001 in Chennai, organized jointly by INFOFISH, FAO-GLOBEFISH, MPEDA AND SEAI and requested them to register for participation.

While emphasising the importance of obtaining license for their shrimp farms from Aquaculture Authority by the farmers, the chairman explained that Aquaculture Authority was set up by an order of Supreme court and a retired High Court Judge was functioning as the Chairman of the Aquaculture Authority. He added that license was a must for all shrimp farms. The Chairman expressed unhappiness that the farmer's response to the system that called upon the farmers to apply for license to the Authority was very poor in Andhra Pradesh. Pointing out that the system of registration of farms with MPEDA was discontinued, he advised the farmers to submit their applications for Aqua license to Aquaculture Authority. In this context, he promised that the MPEDA would not rest until the District Level Committees concerned cleared the applications without delay.

The chairman explained that, in order to counteract a perception among a section of the people that Aquaculture was an environment polluting activity, MPEDA introduced a subsidy scheme for setting up an Effluent Treatment System for shrimp farms having more than 5 ha of waterspread area. The Aquaculture Authority had already approved the MPEDA's design, he added. Stating that the design of ETS would be made available soon, the Chairman said that a closed type of culture system was followed in countries like Thailand to avoid horizontal transmission and in some shrimp farms the same water was used for culture for two years.

Mr.D.S. Murthy, Commissioner of Fisheries, Andhra Pradesh addressing the participants said that out of 7000 applications sold to farmers to apply for the Aquaculture Authority's License, only 2000 nos. of applications were submitted by farmers. Out of an estimated nos. of 70,000 shrimp farmers in the State of A.P, legally there were only 350 licenses as on date. He explained that traditional and improved traditional form of culture practices were permitted in CRZ area and adoption of improved technology was also permitted for increased production and productivity with a maximum permissible seed stocking rate of 60,000 nos./hectare and requested shrimp farmers to provide an opportunity to the department to serve them better and that was possible only when every shrimp farmer obtained license from Aquaculture Authority.

Some of the farmers and hatchery operators had sought certain clarifications, while indicating their interest in applying for licenses. The chairman, while providing clarifications, expressed happiness that the farmers had assured to apply for license from Aqua Authority. He said that MPEDA's subsidy assistance would be extended for new shrimp farms when they would be applying for license, within six months.

The farmers were informed by the chairman that a new scheme was introduced for establishing a chill room with a capacity to store at least 10 mt of shrimp at an estimated cost of 12 lakhs at a place central to the Shrimp Farming Areas and that the subsidy assistance to the extent of 25% of the actual cost of chill room facility, subject to a maximum of Rs. 3.0 lakhs per chill room would be provided.

On this occasion, a brochure on guidelines for "eco-friendly sustainable shrimp farming" prepared by MPEDA's Regional Centre (Aqua), Vijayawada was released by the chairman. Mr. D.S. Murthy, Commissioner of Fisheries, Andhra Pradesh received the first copy. Leaflets on shrimp farming and shrimp hatcheries were also are distributed among the participants. B. Vishnu Bhat, Deputy Director (Aqua), Vijayawada proposed the vote of thanks.

Seminar on HANAQUA Shrimp Feed

Ongole, A.P:22 June 2001

Gold Mohur Foods & Feeds Ltd conducted a Seminar on Hanaqua Shrimp feed at Ongole in A.P. on 22 June 2001. A large number of shrimp farmers and several others connected with shrimp aquaculture participated in the Seminar.

The participants were welcomed by Mr. O. Ramesh, Marketing Executive of Gold Mohur Foods and Feeds.

Mr. R.P. Singh, Head of Aquafeed Division of Gold Mohur Foods & Feeds Ltd (GFFL Ltd), who has the distrinction of catapulting Gold Mohur into an exalted status in aquafeed business re-appraised in his presentation, for the benefit of the farmers, the outstanding qualities of the globally known and widely used Hanaqua shrimp feed, marketed by GFFL Ltd.

The participants listened with rapt attention to the lucid and illustrated presentation made by Mr. Singh. Recalling the prime qualities of Hanaqua shrimp feed which had contributed to its popularity among shrimp farmers, and reeling out the meticulous steps taken over a period of time to ensure that the farmers could really experience the qualitative goodness and economic utility of Hanaqua feed, he highlighted three main factors responsible for the outstanding quality of the feed.

One of these was related to the quality of raw materials used in the feed. At the Hanaqua factory, the best quality raw materials procured from leading suppliers across the globe were being used. Secondly, Hanaqua feed processing technology was of an established reputation and the feed was being produced at a plant at Yanam, part of Pondichery UT, which was erected in technical collaboration with Hanaqua International Corporation of Taiwan. A distinctive feature mentioned by him was that the entire manufacturing process was controlled by a fully automated control panel with each pellet subjected to stringent quality control tests. It was therefore no wonder that the pellets produced at the plant were of world class quality, he added.

Dignitaries on the dais

Mr. R.P. Singh addressing the farmers and other participants

Prof. (Dr.) K. Gopal Rao, Principal, College of Fisheries, Muthukur, Nellore addressing the participants

A view of the participants

R.P. Singh with a group of happy farmers at a pond site after harvesting of a successful Hanaqua (feed) fed shrimp crop.

The World's best quality and most expensive imported Danish fish meal that goes into the manufacture of Hanaqua feed. In the picture are Danish fish meal bags in stock at the plant.

Hanaqua feed production and quality are monitored automatically through computarised control panel.

Pellet quality is monitored strictly for shape, hardness and stability on time at the pellet mill of the fish plant.

R.P Singh said that his company implemented rigorously quality control processes from raw material to the final product, with the result that every bag of feed delivered got packed only after precise quality control tests conducted at the laboratory of international standards at the plant.

It was pointed out that the quality of the product was tested and totally accepted by TASPARC, an organisation reputed for its high quality standards and respected in the sector. Narrating details, he said that Hanaqua feed had been used by TASPARC at a shrimp farm near Nellore in A.P. as part of a commercially-oriented project sanctioned by the Union Department of Bio-technology and implemented by TASPARC. The excellent growth results recorded in three crops taken in a year, bringing an average yield of 6.78 mt/ha was a standing testimony of the superb quality of Hanaqua shrimp feed, he said. A copy of the report published by TASPARC on completion of the project, which contained the results as mentioned above was distributed among the farmers who participated in the seminar.

The objectives of Gold Mohur were not however just restricted to the sale of the feed among the farmers. Pointing out this, Singh said that the Company's objectives transcended the precincts of traditional commercial angle which was of course important. It imparted a developmental dimension by committing itself to provide all needed technical inputs too to the farmers. In this connection, he said that, earlier, the company succeeded in enlisting the services of leading shrimp scientists with global reputation who visited various shrimp farms and provided on - the - spot advice to the farmers. The experts, Dr. Tim Flegel and Mr.Daniel Fegan were in India in June 2000, met a large number of farmers and extended technical guidance to them. The experts also participated then in a series of technical seminars specially conducted for the farmers at Bhimavaram, Amalapuram, Kakinada, Nellore and Vijayawada, all in A.P, he observed. In order to ensure that the imparting of technical guidance to farmers should be on an enduring basis, the company had also sponsored a training programme for the benefit of its technical staff, conducted by Dr. Tim Flegel and Mr. Daniel Fegan.

The seminar was addressed by Dr. K.Gopalarao, Principal, Fisheries College, Muthukur, A.P., and an expert on Shrimp culture. The Professor told the farmers

that the success of shrimp aquaculture was dependent on timely application of technologies with diligence and care for achieving outstanding results. Highlighting that application of sustainable quality-oriented culture practices alone would lead to outstanding results, he exhorted the farmers and farming enterprises engaged in the activity to bear this axiom in mind. He emphasised that all farmers should cultivate a scientific temper to make the best use of the production potential of their farms. He explained that a good percentage of shrimp production came under disease attack, because of unperceived neglect of essentials of farm hygiene by the farmers. He advised the farmers to maintain the farms well while avoiding injudicious application of antibiotics. It was gratifying that farmers were delighted to be supplied with Hanaqua feed, known globally for its uncompromising quality, he concluded.

Mr.Kondalarayudu, President, Shrimp Farmers' Association of Prakasam District, A.P., exhorted the farmers to follow well-founded culture practices bereft of technical deficiencies. This alone would lead to production of healthy shrimps of export quality. Saying that it was not just enough to expect the hatcheries to supply good quality shrimp post-larvae and Gold Mohur to supply quality feed, he exhorted the farmers to match these parameters with proper pond management practices. It was true that there was a good crop last year but this should not lull the farmers into complacency, he cautioned. Several of the farmers had increased the culture area and this had enhanced their responsibility to see that the quality of production was not diluted because of this. He exhorted the farmers to be united and present a common stand, in order to face the onslaught of the exporters who were all one to bring down the purchase price of shrimps.

Prof. P. Haribabu, Assistant Professor, Department of Aquaculture and Pathology, College of Fisheries, Muthukur, A.P., exhorted the farmers to strive to bring down the input costs by avoiding wastages. He expressed the view that the new WTO regime would do good to aquaculture sector.

Dr. Munichandra Reddy, Assistant Professor, College of Fisheries, Muthukur, A.P. told the participants that, in final analysis, seed, feed, water and soil were the four important criteria to be taken care of in aquaculture. Once these four parameters were given due attention, the activity would definitely result in good production and consequential profits. Speaking on feed dispensation, he advised the farmers to provide to the shrimps 65% of the feed during evening time and 35% later in the night. This would facilitate better utilisation, he added.

Dr. Venkata Rao, a prominent and progressive farmer expressed concern over the quality of pro-biotics being supplied to the farmers. He suggested to the Professors of Fisheries College, Muthukur to check the quality of supplies made to the farmers, and keep them informed of the same as such an intervention would keep the farmers abreast of quality aspects. He had also suggested to the Principal of the College to bring out a book on "Water quality management of shrimp ponds". This suggestion was well received and the Principal had agreed to take follow-up action on the suggestion.

Prior Permission needed for Land conversion for aquaculture: A.P. High Court.

In a far reaching judgement, the AP High Court ruled that every farmer who desires to convert his lands for aquaculture has to obtain prior permission from the Aquaculture authority constituted as per the judgement of the Supreme Court and abide by the terms and conditions imposed by the Authority.

This ruling was given by a division bench of the A.P. High Court comprising Chief Justice Satyabrata Sinha and Justice V V S Rao, while disposing of two batches of writ petitions seeking contradictory rulings.

In one set the farmers sought directions against the authorities who interfered with their fish and prawn culture operations within the agriculture lands, as converted for the purpose.

In the other set of writ petitions, small farmers wanted a check on unlimited and unregulated fish and prawn culture operations and sought directions for declaring the said activity as illegal on the ground that the same caused environmental pollution and the fertility of the adjacent agricutural lands was being affected.

The bench observed that merely because the farmers were the owners of the agricultural land they were not free to indulge in conversion of agricultural lands as ponds for unregulated fish and prawn culture. The government was empowered to regulate the raising of fish and prawn ponds, the bench added. Speaking for the bench, the Chief Justice held that farming rights of a ryot vest with the government.

D.N. Prasad takes over as Director (Marketing), MPEDA.

Mr. D.V. Prasad IAS has taken over as Director (Marketing), MPEDA, Kochi on 18 June 2001. Earlier, he was Managing Director of the Karnataka Co-operative Oil Seed Growers Federation Ltd., Bangalore.

G. Santhanakrishnan takes charge as Secretary, MPEDA.

Dr. G. Santhanakrishnan, hitherto Jr. Director (Aqua), MPEDA has taken charges as Secretary MPEDA, Kochi on 31 May 2001. A highly qualified and knowledgeable fisheries professional with vast experience in aquaculture, particularly in shrimp and prawn farming. He had earlier held various positions in MPEDA such as Project Director (PF) and Dy. Director (PF).

MPEDA'S Promotional Programmes

A.P. Shrimp Farmers Major contribution to exports

Shrimp exports fetched Rs.4,578 crores in foreign exchange to India during 2000-2001. The quantity exported was 1,14,524 t. A major share of exports, of the order of Rs. 2370 crores, was earned from A.P. This significant contribution is the result of entrepreneurship of 75,000 farmers of Andhra Pradesh, who have brought 80,000 ha of brackishwater under shimp farming and 20,000 ha under scampi farming. Their activity is well supported by 140 shrimp/scampi hatcheries and nearly 60 feed mills.

The dreaded White Spot Virus is transmitted in two ways among cultured shrimps. Viz., vertical and horizontal. Vertical transmission leads to spread of disease from mother shrimp to young ones. Horizontal transmission pertains to spread of disease through contaminated water, dead shrimps and virus carriers like crustaceans and zooplanktons. MPEDA motivates the farmers to test the seed and mother shrimp with PCR (Polymerase Chain Reaction). This system enables the detection of even a minute virus particle. MPEDA has established three diagnostic labs for the purpose, one each at Vijayawada, Nellore and Bhimavaram, charging a nominal testing fee of Rs. 500/- per sample. The same test in private labs costs more than Rs.1000/-. In order to enable shrimp hatcheries to have mother shrimp, larvae and seeds tested, MPEDA introduced a scheme of granting a subsidy of 50% on capital cost subject to a maximum of Rs.5.00 lakhs for adding a PCR laboratory to them. During the financial year of 2001-2002, MPEDA has earmarked Rs. 1.5 crores to extend this subsidy to 30 hatcheries on first-come-first-served basis. Further, MPEDA provides hands-on training to hatchery technicians on PCR kit operation. Apart from PCR subsidy scheme extended to hatcheries as mentioned above, all shrimp hatcheries, under the surveillance of MPEDA, have been brought under a system of registration to ensure adoption of basic standards and a uniform code of practices stipulated by MPEDA. This system enables hatcheries to produce good quality, disease-free shrimp seeds.

With a view to curtailing the horizontal transmission of viral disease, MPEDA insists upon the farmers to set up effluent treatment system and also to follow eco-friendly and sustainable shrimp farming practices. In order to reduce the organic load in the water discharged from the farm, MPEDA has introduced a subsidy scheme for setting up effluent treatment plant system (ETPS), in shrimp farms of 5 ha and above. Small farmers holding less than 5 ha WSA can join together and establish a common effluent treatment for which subsidy assistance is provided @ Rs. 1.5 lakhs per 5 ha of one unit or 25% of capital cost whichever is less and a beneficiary can avail of a maximum subsidy assistance of Rs. 6.00 lakhs for developing 4 such units in a total water spread area of 20 ha and above. MPEDA will provide guidelines and an approved plan for this system.

To improve the quality of intake water and reduce the excess nutrient level in water drained from the farm, MPEDA has been exhorting the farmers to go for plantation of mangrove saplings in the drainage canals of their farms. For this, MPEDA supplies mangrove saplings free of cost. Since, contamination of water is a major problem in large farms, MPEDA has introduced a subsidy scheme for remodelling a farm or constructing a new farm with water recirculation facilities. Funds are provided to the tune of 75% of the cost of construction of the recirculation facility or a maximum of Rs. 6.00 lakhs whichever is less. Design and technical assistance will be given by MPEDA & CIBA (Central Institue of Brackishwater Aquaculture).

MPEDA has brought out a brochure on sustainable shrimp farming for the benefit of farmers which can be procured free of cost from MPEDA.

In such of the areas where brackishwater tiger shrimp farming is not possible, MPEDA promotes scampi farming, as a viable alternate crop, by extending technical and financial assistance. Apart from scampi, MPEDA has also launched yet another innovative scheme to demonstrate Seabass culture with financial assistance of Rs. 1.75 lakhs to meet the cost of Seabass seed and 75% of the cost of imported pelletised seed. MPEDA extends subidy assistance for undertaking ornamental fish culture also. In this scheme subsidy is limited to Rs. 40,000/- per unit.

MPEDA supplies insulated ice boxes at subsidized rate to enable the farmers to keep harvested shrimp in fresh condition until they can be sent to the processing plants. MPEDA also provides financial assistance in this regard in the form of subsidy for establishing a chill room of upto 10 ton capacity in shrimp farming areas. The subsidy will be limited to 25% of the actual cost of establishment, subject to a maximum of Rs.3.00 lakhs per chill room.

To save the farmers from wrong advice imparted by pseudo consultants, MPEDA launched a unique scheme of registering qualified and experienced aquaculture consultants.

Further, to find out the exact cause of WSSV disease in shrimps, its mode of attack and to formulate, preventive steps, MPEDA has taken up a major study in association with Network of Aquaculture Centre in Asia-Pacific (NACA). The study is expected to yield the information on risk factors and explain the method of eco-friendly sustainable shrimp farming to be followed to overcome the dreaded disease problem.

Centre approves Path-breaking Inland Fishery Pilot Schemes

At an inter-state meeting on fisheries convened by the Fisheries Division of Union Ministry of Animal Husbandry and Dairing held on 11 June 2001 in Delhi, the imperative need for providing fillip to the utilisation of certain inland fisheries, whose development has been lagging behind was considered. As a result, four Inland Fishery Pilot Schemes were identified for implementation during 2001-02. These schemes, related to a) Coldwater Fisheries in the States of Jammu & Kashmir, Himachal Pradesh, Sikkim and Uttaranchal; b) Productive utilisation of Inland Saline Soil for Aquaculture in the States of Uttar Pradesh and Haryana; c) Development of Waterlogged areas into Aquaculture Estates in Bihar, Haryana and Uttar Pradesh, and d) On Development of Reservoir Fisheries in the States of Bihar, Karnataka, Madhya Pradesh and Uttar Pradesh.

Approval was later accorded to the four pilot schemes with a pattern of assistance. The entire expenditure will be borne by the Government of India. The expenditure will be strictly within the approved pattern of assistance sanctioned by the competent authority and no deviation should be made without prior consent of the Union Ministry of Agriculture (Dept. of Animal Husbandry and Dairying). The various states coming under the purview of the respective schemes will receive an equal share of the outlay.

a) Coldwater Fisheries: This scheme has been approved with an outlay of Rs. four crores which is available as one time grant at Rs. one crore each to the states of Jammu & Kashmir, Himachal Pradesh, Sikkim and Uttaranchal. The items/components of the scheme are given in Table I.

b) Utilisation of Inland Saline land for Aquaculture: This scheme has been approved for implementation during 2001-02 in the States of Uttar Pradesh and Harayana with an outlay of Rs.100 lakhs. The items/components to be imple-

Table I. Cold Water Fisheries

S.No.	*Components*	*Unit cost*	*Total cost for 4 States*
i)	Preparation of Survey report and investigation/development of technologies	Rs.10 lakh for each State	Rs.400 lakh for all the 4 States [Maximum amount permissible is Rs.100 lakh for items (ii) to (vi) in case of States where there is no need for taking up item (i)]
ii)	Construction of new and expansion/remodelling of existing farms (including hatcheries)	Rs.50 lakh for each unit	
iii)	Construction of trout farming Units/raceways	Rs.25,000/unit	
iv)	First year inputs	Rs.10,000/unit	
v)	Running water Fish culture units & First year inputs	Rs.42,500/unit	
vi)	Setting up of feed mill unit	Rs.10 lakh/unit	

Table II. Utilisation of Inland Saline Land for Aquaculture

S.No.	*Components*	*Unit Cost*	*Total Cost*
1	Area Development	Rs.2.00 lakhs/ha	Rs.100.00 lakh (approx. 20 ha in each State)
2	Supply of inputs (seed,feed, manures/fertiliser)	Rs.30,000/ha	
3	Logistic support (TA/DA for ICAR & State Fisheries Staff)	Rs.5.00 lakhs	
4	Training of officials & fish farmers	Rs.3.00 lakhs	

Table III : Development of Waterlogged Areas into Aquaculture Estates.

S.No.	*Components*	*Unit Cost*	*Total Cost*
1	Waterlogged Area for Development	Rs.2.00 lakh/ha	Rs.100.00 lakh (approx. 12-15 ha in each State. Total 39 ha in 3 States)
2	Supply of inputs (seeds,feed, manures/fertiliser)	Rs.30,000/ha	
3	Training of officials & fish farmers	Rs.5.00 lakh	
4	Logistic support (TA/DA for ICAR & State Fisheries Staff)	Rs.3.00 lakh	

Table IV. Development of Reservoir Fisheries

S.No.	*Components*	*Unit Cost*	*Total Cost for 4 States*
i)	Feed & Seed	Rs.4 lakh per reservoir (2 reservoirs in each State)	32.00
ii)	Training/HRD	Rs.5 lakh/State	20.00
iii)	Pens/Nets	Rs.5 lakh per reservoir	40.00
iv)	TA/DA for CICFRI (ICAR)	Rs.3 lakh for CICFRI and State Fisheries and Rs.2 lakh for 4 States staff (Rs.50,000/State)	5.00
v)	Contingency	Rs.3 lakh (for all the 4 States)	3.00

mented under the scheme in each of the States are as given Table II.

c) Development of Waterlogged Areas into Aquaculture Estates: This Pilot Scheme carries a total outlay of Rs.100 lakhs and available as one time grant to be equally approtioned among the three States of Bihar, Harayana and Uttar Pradesh. The components of the scheme are furnished in Table III:

d) Development of Reservoir Fisheries: This Pilot Scheme, for implementation in 2001-02 has an outlay of Rs.100 lakhs and this is available as one time grant. The break-up of expenditure on the items / components is mentioned given in Table IV.

The scheme has been sanctioned for implementation in the States of Bihar, Karnataka, Madhya Pradesh and Uttar Pradesh and the amounts to be released as grant will be allocated equally for utilisation with the norms stipulated, and to be shared equally by all the four States.

Fish Farmers Meet

Thanjavur, Tamilnadu: 16th June 2001

This meet was organised by the Fisheries Unit of the Veterinary University Training and Research Centre, Thanjavur of Tamilnadu Veterinary and Animal Sciences University in collaboration with the National Insurance Co., Ltd., Tuticorin Division. This Division has the distinction of introducing a Freshwater Prawn Farming Insurance Policy, defying the general reluctance of insurance companies to extend their services to aquaculture sector.

Dr. V. Sudararasu, Registrar, Tamilnadu Veterinary & Animal Sciences University Delivering Presidential Address during the Fish Farmers Meet.

Dr. R. Suresh, Associate Professor (Fisheries) welcomed the gathering and explained the extension support provided by the V.U.T.R.C., Thanjavur to the fish farmers of the region. Dr. V. Sundararasu, Registrar, Tamilnadu Veterinary and Animal Sciences University, Chennai presided over the meeting. He formally launched the freshwater prawn farming insurance policy of the National Insurance Company Ltd., as applicable to its Tuticorin Division. Dr. R. Kanagaraj, Assistant Divisional Manager, of the company, introducing the policy, explained the details thereof.

Dr. M. Nagoor Meeran, Assistant Professor (Fisheries) explained the present scenario and the scope for freshwater aquaculture development in the region with special emphasis on freshwater prawn farming as an income generating alternative enterprise to the farmers. Mr. M. Narayanan, Assistant General Manager, NABARD, Thanjavur, Mr. C. Vijayakumar, Asst. Director, MPEDA, Thanjavur, Mr. J. Singarayan vaz, manager, National Insurance Company Ltd., Tuticorin spoke on the occasion.

74 farmers of Thanjavur, Trichy, Thiruvarur, Nagapattinam, Perambalur, Ariyalur and Cuddalore districts of Tamilnadu participated in the meet. Clarifications on the queries raised by the farmers were provided by the various fisheries experts present.

The farmers appealed to the Government to consider providing concessional electricity tariff for freshwater aquaculture as the present commercial tariff charged rendered freshwater aquaculture unremunerative in the State. The farmers were happy and expressed their gratitude to the Insurance Company for the introduction of the freshwater prawn farming insurance policy. They felt that this provision would bring in more institutional finance apart from providing risk coverage to the capital intensive freshwater prawn farming in the region. Mr. Kishore D Fernandez, Development Officer, National Insurance Co., Ltd., Tuticorin proposed the vote of thanks.

Fish oil retards ageing

A fish a day keeps the wrinkles (and the blues) away, according to a marine biologist in Italy.

Silvio Greco of the Italian National Research Council says fish contains molecules forming the omega-3 fatty acids, 10g per day of which help to lift depression. The acids do this by raising the body's levels of serotonin, a chemical produced in the brain that acts on the nervous system.

'These oils protect the heart, slow down the ageing process and fight the notorious free radicals associated with the development of cancer', Mr Greco says. 'Ideally, everybody should eat one small fish a day', it is said.

Source: Seafood International.

R. Ganapathy, now Director, MPEDA

Mr. R. Ganapathy hitherto Secretary, MPEDA has assumed charge as Director, MPEDA, Kochi on 31 May 2001. A post graduate in Marine Biology with specialization in Fisheries, Mr. Ganapathy started his career in CMFRI in 1965 and later worked at CIFRI before joining MPEDA in 1976 as Asst. Director. He had held various positions in MPEDA such as Resident Director, Trade Promotion Office, New York, Project Director, Rajiv Gandhi Centre for Aquaculture, Mayiladuthurai, a project of MPEDA and Joint Director (Prawn Farming).

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Guidelines for Management of Andhra Pradesh Reservoirs

A.K. Das, Ch. Gopalakrishnayya and M. Ramakrishniah
Reservoir Division of CICFRI
Rajajinagar, Bangalore - 560010

Reservoirs constitute the prime inland fishery resource of India by virtue of their vast area and huge production potential. Since large multipurpose reservoirs are to be managed on capture fishery principles, the fishery regulations and controls are to be excercised to ensure sustainable yields from them. As pointed out by Nikolsky (1971), fishing is liable to change the growth rate, population structure and reproductive capacity of the population. Some management measures are, therefore, to be taken to control the fishing activity for optimum utilization of the resources and for economic returns to the fishermen. Before deriving the guidelines for management, certain studies related to their yield potential, availability of fish food resources and relationship between different niches are required to be undertaken in detail. The present communication deals with certain guidelines for management of some selected reservoir of A.P. under three riverine systems, as no reservoir is being managed scientifically at present. Hence, this study will go a long way to enhance fish production in these water bodies.

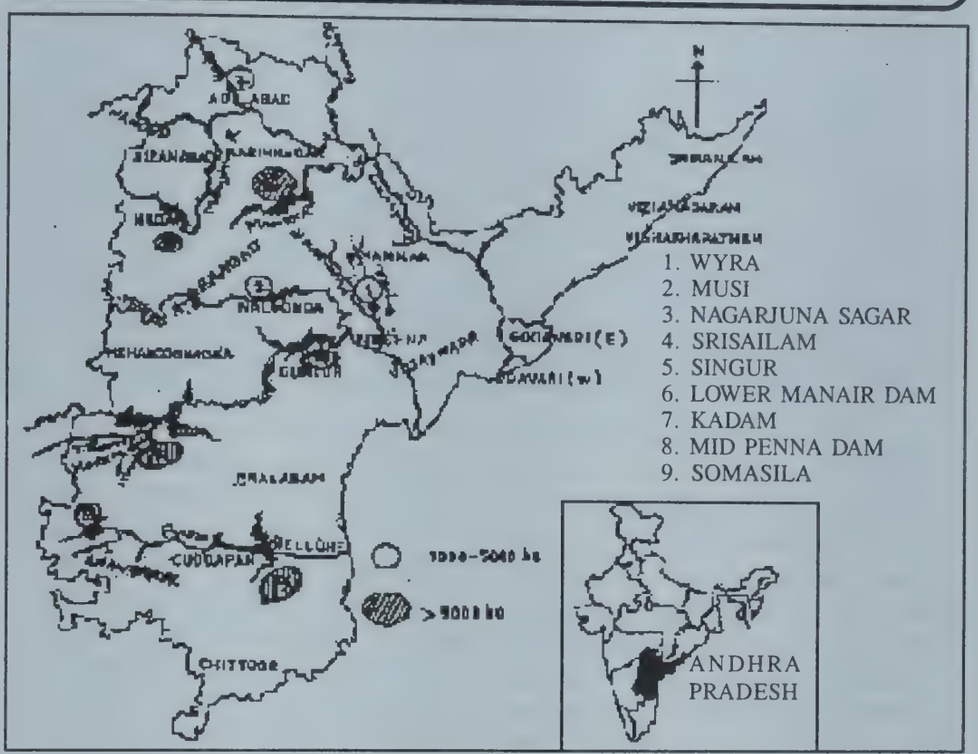

Fig 1. Distribution of reservoirs in Andhra Pradesh

Reservoirs studied

Nine reservoirs were selected from three river systems where four pertaining to Krishna, viz., Wyra, Musi, Nagarjuna sagar and Srisailam, three to Godavari, viz., Singur, Lower Manair Dam (LMD) and Kadam and two to Pennar river systems, viz., Mid Pennar Dam (MPD) and Somasila. Srisailam and Nagarjuna sagar are the mainstream reservoirs of Krishna, while Musi and Wyra are on tributaries of Krishna. Singur, Kadam and LMD are on the tributaries of Godavari viz, Manjira, Kadam and Manair respectively. MPD and Somasila are mainstream reservoirs of Pennar.

Salient morphometric and hydrographic features

Some of the salient morphometric and hydrographic feastures of these reservoirs are projected in Table 1. Out of the nine reservoirs, Srisailam is the biggest (61,404 ha at FRL) and Mid Pennar Dam is the smallest one (1703 ha). The catchment of all the reservoirs lies in the Deccan plateau covering mostly denuded deciduous forests and intensely cultivated agricultural and waste lands with moderate to low rainfall. The ratio of catchment to reservoir (C/A) area (at FRL), which is considered to be an index of allochthonous inputs, varied widely from 43 (Wyra) to 756 (Nagarjuna sagar). The storage capacity of Nagarjuna Sagar is the highest in the country at 11560 mm^3 and the lowest is Wyra with 64.7 mm^3. The flushing rate (annual inflow/storage capacity) is the highest in Srisailam (4.9) followed by N. sagar (93.7), Kadam (3.6), Wyra (3.0) and Mid Pennar Dam (2.5), low in Lower Manair Dam (1.0), Somasila (1.2), Singur (0.7) and Musi (0.7). The annual inflow and flushing rate have positive effect on productivity of the reservoir as they have a direct bearing on the loading of allochthonous inputs. The shore development index indicating the degree of irregularity of shoreline is the highest in Srisailam (12.9) followed by Singur (8.4) and Kadam (8.0). In others, it varied from 3.5 (Mid Pennar Dam) to 7.9 (Nagarjuna sagar) reflecting that the shoreline of Srisailam, Singur, Kadam and Nagarjuna Sagar are highly irregular with number of coves and bays. The volume development index, indicative of nature of basin wall towards water is less than unity in all the reservoirs except Nagarjuna sagar and Musi (cup shaped) depicting saucer shaped basins (basin wall convex towards water).

Considering the morphometric and hydrological characteristics, Srisailam, Kadam and Wyra could be considered as more productive reservoirs. Musi, receiving effluent and city sewage from Hyderabad with low flushing rate is a pol-

Table 1. Morphometric and hydrographic features of reservoirs of A.P

River System	Krishna River System			Godavari River System			Penna River System		
Reservoir	*Wyra*	*Musi*	*N.sagar*	*Srisailam*	*Singur*	*LMD*	*Kadam*	*MPD*	*Somasila*
River	Wyra	Musi	Krishna	Krishna	Manjira	Manair	Kadam	Penna	Penna
Locatiion	Khammam	Nalgonda	Guntur	Kurnool	Medak	Karimnagar	Adilabad	Anantapur	Nellore
Latitude (N)	17°11'	17°14'	16°34'	16°50'	17°45'	18°24'	19°18'	14°52'	14°29'
Year of construction	1930	1963	1969	1984	1989	1986	1958	1964	1988
Elevation (m) MSL	95.8	196.6	179.8	269.7	523.6	280.5	213.4	365.7	100.6
Bed level (m) MSL	77.2	181.3	73.1	167.6	500	258.6	185	335.3	67.1
Maximum depth (m)	18.6	15.3	106.7	102.1	23.6	21.9	28.4	30.4	33.5
Mean depth (m)	3.9	5.2	40.5	14.2	5.1	8.4	8.9	8.5	10.3
Area at FRL (ha)	1626	2507	28474	61404	16534	8103	2474	1703	21349
Average area (ha)	1074	1400	18429	33689	8700	4833	1842	889	12695
Catchment : Area	43	361	756	334	97	80	104	79	228
Capacity (10^6m^3)	64.7	130.3	11560	8721	849.5	680.6	215.3	146.1	2208.4
Annual inflow (10^6m^3)	193.7	87.7	42358	36449.9	595.8	661	773.1	373.8	2562.5
Shore dev. index	5.6	3.6	7.9	12.9	8.4	4.7	8	3.5	6
Volume dev. Index	0.64	1.02	1.14	0.42	0.66	0.94	0.95	0.84	0.73

luted one where mortality of fishes occurs often.

Some salient environmental features of water

Shallow reservoirs with high transparency are more productive (Ryder, 1965) which is also true in the case of A.P. reservoirs under study. Transparency of these reservoirs was maximum during pre-monsoon months due to stabilization of suspended clay micelles with less pronounced planktonic shading. On an average, euphotic zone in all the reservoirs was extended even more than 2.0 m year round signifying a productive quality of waters. The reservoirs under study are situated in one of the warmest regions of India having no winter season and where minimum air temperature never drops below 20°C and summer temperature ranges between 35 and 45°C thus preventing the formation of any thermal stratification in water column generally. The air and water temperatures ranged from 28.0 to 34.0°C and 25.5 to 32.0°C respectively in these reservoirs during the sampling periods (Table 2).

Temporal variation in dissolved oxygen (DO) (ppm) was not significant in these reservoirs ranging from minimum of 6.4 to a maximum of 8.4. Musi, being a polluted and highly eutrophic one, showed a higher DO content in pre-monsoon (10.0) due to algal bloom. Andhra soil is basically alkaline in nature which is reflected in water pH showing medium to high alkaline pH in the range 8.35 to 9.98. Wyra showed a pH of 9.98 and Kadam 9.80 due to high $CaCo_3$ content in their soils. Chemical stratification occurred during pre- and post-monsoon with steeper oxycline in Lower Manair Dam, Kadam, Mid Pennar Dam, Somasila and could be categorised as productive reservoirs. In Musi, almost anoxic condition prevailed at 8 m depth due to organic load. Alkalinity showed an increasing trend in pre-monsoon exhibiting clinograde distribution which was well marked in Kadam, Srisailam and Lower Manair Dam. However, in some others, it showed a reverse trend. pH showed a decreasing trend with depth, but the variation was not very remarkable.

In all the reservoirs the concentration of nitrogen and phosphorous is rather poor (Das, 1998); NO_3-N was in traces in most part of the year. However, the level of NO_3-N (ppm) improved during post-monsoom months to the extent of 0.56 (Kadam) to 0.86 (N.sagar) and it appears to get dissipated quickly in the system. PO_4-P was also recorded in traces in pre-monsoon and monsoon months. The concentratiion of silicates (SiO_2-Si) appeared to be normal in the range 6.4

Table 2. Physico-chemical characteristics of water (range) in reservoirs of A.P

Parameters	Wyra	Musi	N. Sagar	Srisailam	Singur	LMD	Kadam	MPD	Somasila
Temp (°C)	29.0-30.01	29.5-30.0	28.5-30.0	28.5-28.8	25.5-29.0	28.0-32.0	28.5-30.5	28.8-30.0	29.0-31.0
Transp. (cm)	42-120	40-90	195-200	130-142	100-180	120-177	100-140	95-170	40-140
pH	8.2-9.9	8.1-9.8	8.4-8.8	7.9-8.8	8.0-9.2	8.3-9.2	7.9-9.8	8.1-8.9	8.1-8.5
DO (ppm)	6.4-7.6	6.4-10.0	8.0-8.8	7.2-8.6	6.8-7.6	6.8-8.0	7.1-9.6	7.4-7.8	6.8-7.4
TA (pm)	152-218	196-260	96-128	100-120	116-144	124-128	146-156	64-112	100-156
TDS (ppm)	260-526	630-1072	286-370	279-455	182-253	208-266	214-318	143-253	208-539
NO_3-N(ppm)	Tr-0.68	0.07-0.82	Tr-0.86	Tr-0.60	Tr-0.82	Tr-0.74	Tr-0.56	0.05-0.62	Tr-0.60
PO_4-P (ppm)	Tr-0.01	Tr-0.02	Tr-0.01	Tr-0.02	Tr-0.02	Tr-0.01	Tr-0.01	Tr-0.02	Tr-0.02
SiO_2-Si(ppm)	7.6-16.8	4.4-12.2	7.2-9.8	6.6-9.0	6.0-11.4	7.2-9.6	9.4-16.8	4.4-10.6	4.8-8.6

(Somasila) to 13.9 ppm (Kadam).

Production potential

Primary production (mean levels) in different reservoirs is depicted in Table 3. Barring Musi where gross production (GP) (mg C/m^3/d) was exceptionally high (6094), in other reservoirs it was in the range of 833 (Nagarjuna sagar) to 1916 (Wyra). Post-monsoon and monsoon seasons exhibited higher rates. This trend is generally expected as the nutrients loaded during monsoon are available for production in post-monsoon months. Assuming a judicial conversion efficiency of 0.2% GP for bigger reservoirs and 0.4% GP for medium and small reservoirs the potential fish yield (PFY) (kg/ha/y) has been estimated at 280 kg in Wyra, 202 kg in Kadam, 100 kg in Srisailam, 162 kg in MPD, 77 kg in Somasila, 73 kg in Singur, 69 kg in Lower Manair Dam and 61 kg in Nagarjuna sagar. Wyra, Kadam, Mid Pennar Dam and Srisailam are in higher category of production with a potential higher than 100 kg/ha and in others the range being 61 to 77 kg. Under normal exploitation levels 60-70% of the potential could be the yield. In all probability the actual yield would be much higher because the allochthonous organic matter contributes substantially to fish yield in reservoirs. No effort has been to estimate the potential production of Musi as it is a polluted reservoir. Its potential is bound to be substantially higher than all the reservoirs studied.

Plausible guidelines for management

At present no reservoir is being managed scientifically. Presence of major carps in the catches indicates stocking of these species but actual figures are wanting. The reservoirs are being exploited by various means and the necessary effort is available. What is needed is a sound management programme based on the yield potential and availability of fish food resources. A brief outline on the scope for management of individual reservoir is given below.

Wyra reservoir: It is the only reservoir where *Macrobrachium malcolmsonii* contributed substantially to the catch. The prawn is probably getting recruited naturally from river Krishna and negotiating the dam contributing to the autostocking. Besides prawn, major carps are being caught at small size. There is a need in this reservoir to enhance the minimum mesh size from its present size which is at 2.5 cm. Traps should be directed for exploiting prawns and gill nets with minimum mesh of 10 cm (5.0 cm bar) to exploit fishes. Wyra has a good population of zooplankton and fairly rich bottom fauna consisting of *Tendepes* and other dipteran larvae. Besides catla and rohu, addition of common carp should be considered for stocking in order to utilise the bottom biota. As the reservoir is shallow, exploitation of common carp will not pose a problem. Wyra being a seasonal river, breeding and successful recruitment of stocked carps may not be possible and this warrants their continuous stocking. Though the fish production potential has been estimated around 160 kg it is likely that the actual yield would be much higher. A stocking programme with emphasis on catla and common carp along with rohu and mrigal on a continuing basis should be undertaken to realise the potential. The stocking rate could be around 300-400 fingerlings/ha of size between 75-100 mm. If larger fingerlings (>100 mm) could be stocked, the stocking rate may suitably be reduced.

Musi reservoir: It is a polluted reservoir with fish mortality occurring during summer. Major carps, catfishes, miscellaneous fish and prawns account for the commercial catch. The flushing rate of Musi is very low at 0.7 which makes the environment unfavourable during summer. Any effort to increase the flushing rate will have a salutory effect on the quality of water and its productivity. The reservoir is being exploited by 1200 units with minimum mesh size used being 1.2 mm. Fishing intensity appears to be rather high for the size of the reservoir. *M. malcolmsoni* is getting recruited through the river Krishna as in Wyra. The reservoir has a fairly rich crop zooplankton and equally rich bottom fauna consisting of larvae of chironomids and other dipterans. No farm facility is available at the resrvoir. It is worthwhile to consider stocking Tilapia and murrels (*Channa striatus* and *C. punctatus*) which thrive well under testing conditions as observed in Musi. Addition of common carp could also be considered to utilise the rich faunal stock of larvae of chironomids and other dipterans. The minimum mesh size of nets may be raised suitably depending on the type of fishery developed.

Srisailam reservoir: It is the largest reservoir of the State in terms of area and also productivity. Because of its spread, problems are faced in the exploitation and landing of the catch. Major carps are being exploited in considerable quantities. It is not known whether they are stocked or recruited from the downstream Nagarjunasagar. The reservoir has several incoming rivers which form suitable breeding gounds for major carps. The present studies are too inadequate to come up with any tangible management measures. In

Table 3. Primary production and Fish yield (kg/ha/y) in A.P. reservoirs

Reservoirs	GP (mgC/m^3/d)	NP (mgC/m^3/d)	Respiration (mgC/m^3/d)	Photosynthetic efficiency(%)	Assimilation efficiency(%)	Fish yield	
						Existing	Potential
Wyra	1916	1583	383	0.87	80.3	31.7	280
Musi	6094	4928	1399	2.78	81.7	21.7	-
N.sagar	833	583	300	0.37	69.4	7.5	61
Srisailam	1371	879	675	0.62	64.2	4.8	100
Singur	1000	639	433	0.45	63.5	3.38	73
LMD	950	642	370	0.44	64.8	6.21	69
Kadam	1383	1137	296	0.64	80.8	13.57	202
MPD	1106	807	359	0.50	72.2	12.5	162
Somasila	1058	708	420	0.47	64.7	5.2	77

view of this, it is worthwhile to undertake detailed studies on this reservoir. While Nagarjuna Sagar, the downstream reservoir has been studied in detail in seventies, Srisailam reservoir being of a different category could not as yet be studied and it needs a thorough study to understand its management problems.

Singur reservoir: It is a relatively a new impoundment meant for supply of water to Hyderabad city. Indications are that the reservoir is a medium productive one with moderate plankton density and fairly rich bottom fauna. Zooplankton is dominant in plankton with chironomid larvae and molluscs as preponderant bottom fauna. The reservoir is being exploited by about 226 units with gillnets employing thermocole rafts. The catches consist of rohu, mrigal and other fishes. It is necessary to develop fisheries of the reservoir not only to improve the fish productivity but also to keep the environment clean. Besides giving emphasis on stocking catla, rohu and mrigal only, common carp and mahseer (*Tor khudree*) should also be included in the stocking programme. Inclusion of *T. khudree* also will not only control molluscs but also helps in the conservation of this important species. Being a drinking water reservoir, pen and cage culture systems cannot be introduced. The flushing rate of the reservoir is low and the water level might go down drastically in summer due to other exigencies of water requirement and the fishery manager has no say in the matter of water management. Hence, the extent of reduction in area during summer should be taken into consideration while formulating measures for development of fisheries of the reservoir. Thermocole rafts could be replaced by coracles to increase the efficiency of exploitation.

Lower Manair Dam: This is a large new impoundment of Godavari basin with medium productive potential. Besides inflows from catchment, it also receives water from Kakatiya canal as it is a balancing reservoir. The plankton and bottom fauna are of low to moderate density with dominance of zooplankton in the former and chironomid larvae in the latter. The fishing effort appears to be low. Catch consists of a mixture of major carps and indigenous species. The flushing rate is about one indicating that the flood flows into the river above may not be adequate for successful breeding and recruitment of major carps. Stocking should include catla, mrigal and rohu in the order of importance with 50% of catla. Depending on the catches the fishing effort could be increased further by increasing the length of gillnets in each unit.

Kadam reservoir: It is a forty year old impoundment with favourable drainage and ecological features indicative of high production potential. Fish food resources are fairly rich with zooplankton prevailing in plankton and dipteran larvae in bottom biota. Fishery consists of mostly indigenous fishes which include the mahseer, *T. khudree*. No stocking figures are available. The reservoir needs stocking support to realise the potential and the species should include catla, rohu and mrigal in the proportion of 4:3:3. Rate of stocking and size of seed could be as in Wyra. The reservoir has a farm attached where the necessary seed could be raised.

Mid-Pennar reservoir: Main stream reservoir of river Pennar, it gets much of inflows from the high level canal of Tungabhadra resrvoir. It shows signs of productivity with strong oxycline and favourable drainage characteristics. It is rich in zooplankton and bottom macrofauna. The catch consists of stocked carps and local fishes. Fish species occurring in Tungabhadra reservoir such as *P. kolus*, *L. potail*, *M. seenghala* have also been observed in this reservoir. The stocked carps especially catla showed signs of good growth. The reservoir is being exploited by about 100 units employing gillnets, castnets and traps. The potential of the reservoir could be realised with stocking of catla, common carp, mrigal and rohu in the order of importance with greater emphasis on catla and common carp. Farm facilities are available at the dam to raise the necessary seed. No natural recruitment of major carps could be expected and stocking would have to be on continuing basis.

Somasila reservoir: One of the reent impoundments, the reservoirs showed signs of oligotrophy with weak oxycline and low abundance of fish food organisms. It is a balancing reservoir with more than half of inflows coming from Telugu Ganga Canal from Srisailam reservoir. At present about 64% of the catch consists of carps. Catla and mrigal show signs of good growth while that of rohu is poor. The reservoir needs stocking support with emphasis on catla and mrigal to realise the potential. About 1500 units of fishermen are exploiting the reservoir with gill nets. A farm also exists attached to the reservoir for raising the required seed.

Conclusions

Most of the reservoirs have the necessary infrastructure for raising the seed and for exploitation of their fishery. Co-operative societies need to be activated and given the responsibility of management. The fishermen should be made partners in the management.

It is to the credit of private entrepreneurship in Andhra Pradesh, that the state has come to occupy a leading position in the field of carp and shrimp culture. In view of this, it would be worthwhile leasing out selected reservoirs to the private sector on a reasonably long-term basis. If this system succeeds, it could be extended to other reservoirs.

The steep water level fluctuations in several of the reservoirs is a constraint for the introduction of pen culture to raise the seed. Such of the reservoirs which favour pen culture operations for seed rearing may be identified. Any reservoir which gets filled up early in the monsoon and retain that level for 2 to 3 months would be suitable for rearing of seed in pens.

There is an immense scope to introduce cage culture systems in most of the reservoirs. This system will enhance the yield from reservoirs and also provide additional employment.

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Reservoir Fisheries in Solapur District of Maharashtra

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India is having 3.1 million ha of reservoir area which is expected to go up two-fold by 2020 (Sugunan 1995). Indian reservoirs have potential of providing employment to about two million people (Khan *et al* 1991). This potential has been playing an increasingly pivotal role in providing employment to people in the rural sector in a significant way.

Despite considerable developmental effort, present fish yield from Indian reservoirs continues to be low. Indian Institute of Management (IIM), Ahemadabad (1984) made a sample survey of 32 reservoirs of different categories and found that the fish yield varied from 1-12 kg/ha/yr. This range may have gone up in the past 10 years but certainly not significantly. The National Commission on Agriculture (1976) suggested an average fish production of 40 kg/ha/yr from all Indian reservoirs could be obtained by adopting new management techniques.

Among States of India, perhaps Maharashtra is having the largest reservoir area which is 2,73,750 ha (1,19,515 ha small, 39 181 ha large and 1,15,054 ha medium reservoirs), as estimated by Sugunan (1995). However, Bhartiya (1990) mentions total reservoir area in the State is of the order of 2,36,157 ha. It appears that no reliable information is available because some of the reservoirs are under the control of Zilla Parishads, some under Irrigation Department and others under the control of State Electricity Board. According to IIM, Ahemadabad (1984), there are only 72 reservoirs having a waterspread area of 1,05,202 ha. The present investigation was taken up to gather detailed information on the fisheries of some important reservoirs in Solapur district of Maharashtra. Sugunan (1995) mentions that Solapur district is having 26,812 ha of reservoir area comprising small reservoirs of 10-500 ha, (4,752 ha), medium reservoirs of 500-1000 ha (1509 ha) and 20,551 ha of large reservoirs (> 1000 ha).

Table 1 : Morphometric characteristics of some important reservoirs in Solapur district

Name of the Reservoir	*Ekruk*	*Hingni*	*Jawalgaon*	*Pathri*	*Ujjini*
River	Aghili	Bhogawati	Nagzari	Yerali	Bhima
Year of Construction	1871	1976	1977	1905	1978
Waterspread area(ha)	1842	1006	858	276	29000
Length of Dam(m)	2134	1987.80	1230	2069.60	—
Depth of Dam(m)	21.45	21.87	21.71	19.43	10.7
Rainfall at catchment area (mm)	723.90	582.00	655.00	750.00	655

The Jawalgaon reservoir supplies water for irrigating about 4,451 ha of area. The detailed morphometry of reservoir has been depicted in Table 1. The reservoir was constructed in year 1977 at village Jawalgaon situated on Tuljapur-Vairag road, about 27 km from Tuljapur. Sakhare (2000) mentions the presence of 23 fish species in this reservoir, Cypriniformes, dominated with 11 species of the order followed by order Siluriformes (4 species), while the orders like Osteoglossiformes, Perciformes and Channiformes were recorded with two species each. The rest of the orders are found to have one fish species each (Table 2). Surface gill nets are the main gear used for fishing, while cast-nets, hooks and lines are also used. The gill nets, prepared from low quality nylon yarn, are commonly known as disco-nets. These are trammel nets. The fishermen of this reservoir use a simple craft called 'Nav'. It has a flat area of 6 x 3 feet with a depth of 4-10 inches. It is made of thermocole and is covered by a plastic sheathing.

The present fish productivity of the reservoir has been estimated on the basis of interviews with 44 fishermen engaged in fishing of reservoir. Based on interviews with the local fishermen, the per day catch per fisherman is estimated to be approximately 2 kg only and the per hectare fish yield from the reservoir is about 37.43 Kg/ha/yr.

Hingni (Pangaon), the second important reservoir in the district was constructed in 1976 near village Pangaon and Hingni. The fish yield per hectare is calculated at 69.84 kg. There has been no regular stocking of the reservoir with fingerlings of Indian major carps or with others. The major fishery of the reservoir is supported by *Channa marulius, Mastacembelus armatus, Ambassis* spp., *Mystus* spp etc. Gears used in fishing are the same as in Jawalgaon reservoir. Country boats made of locally available wood are the main crafts used for fishing. 'Nav' (as described in Jawalgaon reservoir) is also used.

Ujjini, another large reservoir of the State is constructed across river Bhima. Sugunan (1995) mentions the per hectare fish yield from Ujjini reservoir is about 24.3 kg. According to IIM, Ahmedabad (1983), the reservoir was stocked with fingerlings of Indian major carps at two nos of them per hectare. The fish catch from this reservoir is generally transported to Pune or Solapur fish markets. Gears employed for fishing are chiefly the gillnets. Wooden country boat is the only craft used in fishing.

There are two smaller reservoirs, i.e.,

Table 2: Fish fauna of Jawalgaon reservoir

Order	: Osteoglossiformes
Suborder	: Notopteroidei
Family	: Notopteridae
	1. *Notopterus notopterus* (Pallas)
	2. *Notopterus chitala* (Ham.)
Order	: Cypriniformes
Suborder	: Cyprinedei
Family	: Cyprinidae
	3. *Catla catla* (Ham.)
	4. *Cirrhinus reba* (Ham.)
	5. *Cirrhinus mrigala* (Ham.)
	6. *Labeo rohita* (Ham.)
	7. *Labeo calbasu* (Ham.)
	8. *Cyprinus carpio* (Linn.)
	9. *Hypopthalmicthys molitrix* (Val.)
	10. *Puntius sophore* (Ham.)
	11. *Puntius sarana* (Ham.)
	12. *Puntius ticto tict* (Ham.)
	13. *Puntius kolus* (Sykes)
Order	: Perciformes
Suborder	: Percoidae
Family	: Centropomidae
	14. *Chanda nama* (Ham.)
	15. *Chanda ranga* (Ham.)
Order	: Siluriformes
Family	: Silurudae
	16. *Ompak bimaculatus* (Bloch)
	17. *Wallago attu* (Schneider)
Family	: Bagridae
	18. *Mystus seenghala* (Sykes)
	19. *Mystus cavassius* (Ham.)
Order	: Mugiliformes
Family	: Mugilidae
	20. *Rhinomugil corsula* (Ham.)
Order	: Channiformes
Family	: Channidae
	21. *Channa marulius* (Ham.)
	22. *Channa gachua* (Ham.)
Order	: Symbrachiformes
Family	: Gobidae
	23. *Glosogobius giuris giuris* (Ham.)

Ekruk (1842 ha) and Pathari (276 ha) in the district. During the past few years the reservoirs are given on lease to private parties for fishing. Both the water bodies are regularly stocked and harvested by the owners. The per hectare yield calculated was about 48 and 72 kg for Ekruk and Pathari reservoirs respectively. Tyre and tubes of automobiles are also used as crafts.

The fish landings from all the above reservoirs except Ujjini goes to the fish markets of Mohal, Barshi, Vairag, Akluj, Mangalweda, Sangola, Modnimb, Madha, Pandharpur etc.

Conclusion

The study has shown that the fish yield from Ujjini reservoir (10-15 kg/ha/yr) is quite comparable to the average production of Indian reservoirs, Other reservoirs like Jawalgaon, Hingni (Pangaon) Ekruk and Pathri are found to have an average production ranging from 47 to 72 kg/ha/yr. Hingni (Pangaon) shows high fish yield, despite the fact that the reservoir is not being regularly stocked with fingerlings of Indian major carps. The crafts used in fishing are of traditional type.

In this background, the following recommendations are made :

1) The Hingni (Pangaon) reservoir should be stocked with adequate number of advanced fingerlings of Indian major carps in a pre-determined ratio.

2) The State Government should provide sufficient funds to fishermen, to enable them to run the modern crafts and operate good quality nets.

3) Monitoring of productivity, hydrobiological parameters and other ecological conditions of the reservoir should be done by establishing a small field laboratory. The data on stocking, production and socio-economic conditions of fishermen should also be maintained by this laboratory.

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V.V. Sugunan, Director, CICFRI

Dr.V.V.Sugunan has taken over as Director, Central Inland Capture Fisheries Research Institute, Barrackpore on 8 Aug 2001, in the place of Dr. A.K. Ghosh who retired from service on superannuation.

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National Seminar on Riverine and Reservoir Fisheries : Challenges and Strategies

23-24th May, 2001, Cochin

This seminar was organised by the Society of Fisheries Technologists (India) in association with the Central Institute of Fisheries Technology, Cochin.

The seminar was inaugurated by Mr. N.V.Madhavan, Principal Secretary, Government of Kerala. Dr.K. Gopakumar, Deputy Director General (Fy), ICAR presided over the function. Mr .T.Thankappan IAS, Director of Fisheries, Govt. of Kerala and Mr. Joseph Edward, M/s India Sea foods, Cochin offered felicitations. Dr. K.Devadasan, Director, CIFT welcomed the gathering and Dr P.T.Mathew, Secretary, SOFT(I) proposed vote of thanks. The seminar was well attended. Several of the participants highlighted the constraints in the development of inland fisheries and proposed new strategies for the development and utilisation of the resources of this sector at sustainable level.

Mr. N.V. Madhavan, Principal Secretary, Govt. of Kerala delivering inaugural speach.

Dr. D.N. Singh, CICFRI making a presentation on Capture Fisheries

Mr. N.V. Madhavan, Principal Secretary, Govt. of Kerala lighting the traditional inaugural lamp Standing L to R : Mr. T. Thankappan, Director of Fisheries, Kerala, Dr. B. Meenakumari, Convenor, Dr. K. Devadasan, Director, CIFT, Mr. Joseph Edward, M/s. India Seafoods, Cochin, Dr. P.T. Mathen, Secretary, SOFT(1), and Dr. Gopakumar, DDG (Fy), ICAR.

The following salient aspects in respect of the status of Indian inland fishery sector emerged during the presentions made at the seminar. Inland fish production of India increased from 0.22 million t in 1950-51 to 2.8 million t in 1999-2000 making India the second largest producer of inland fish, next only to China. The freshwater resources of India include 29,000 km length of main rivers and important tributaries, 2.09 million ha. of lakes and reservoirs, about 1.30 million ha of beels, jheels and derelict water bodies, 0.12 million km of canals and channel network, 2.25 million ha of ponds and tanks and another 2.3 million ha of water logged paddy fields. At present about 78% of the inland fish produced in India (2.18 million t) is derived from aquaculture and 22% from capture fisheries (0.62 million t). About 200 species constitute the inland lentic icthyofauna of which more than 100 are of significant commercial importance. About 0.45 million fishermen depend upon inland fisheries for their sustenance. Targeted fish production from the inland sector is about 8 million t by 2020 AD, in order to maintain the per capita consumption at the current level.

Objectives : The objectives of the seminar were outlined by K. Devadasan as follows :

- to take a look at the recent developments in the inland fisheries sector of India;
- to review, consolidate and document the available scientific information on inland resource systems, their harvesting, utilisation and management; and
- to evolve suitable strategies for the development of inland fishery resources, on scientific lines, leading to renewed growth of this vital sector.

The deliberations of the seminar highlighted the following aspects.

It was pointed out that the inland fishery resources were facing threats on ac-

Dr. Gopakumar, DDG (Fy) delivering the presedential address

Dr. N.R. Menon, Director, School of Marine Sciences, chairing the session on Ecology

count of unscientific application of technological advancements. Besides this, inland fisheries, especially reservoir fisheries, were being gradually destroyed by deforestation leading to soil erosion and silting, industrial pollution and pressures of urbanisation. Construction of dams for irrigation and power generation were also affecting the inland fishery resources. Focusing attention on the all round development, and evolving better policies and guidelines for the scientific development were the need of the hour. Crude harvesting methods like use of under-water explosives, poisonous substances etc for indiscriminate killing of fishes continued to be adopted despite legal regulations in force. Destructive fishing gears continued to be used for fishing in rivers and reservoirs. Closed seasons to provide protection to brooders were not being strictly observed. The fishermen would have to be educated about the rules and regulations to be followed for the sustainability of the system.

On the post harvest side, major problems in freshwater fishes were identified as the lack of facilities for transportation, insufficient processing facilities and absence of dependable domestic markets for processed products. Because of this, the fishery in this sector was being underutilized. It was voiced that the aim must be to utilise this wealth for development of value-added products for channelisation into the domestic as well as international markets.

The seminar was organised into five Sessions.

Technical Session -1: This session dealt with Ecology. Twelve papers dealing wih aspects such as limonolgical status, ecology, environmental degradation, siltation and pollution, were presented. The Session was chaired by Dr. N.R. Menon, Director, School of Marine Sciences.

Technical Session -2 : This session was devoted to Resources. Ten papers dealing with the status of inland fish production, ornamental fisheries, biology and distribution of freshwater fishes and approaches for their enhancement, were presented in this session which chaired by Dr.P.V. Dehadrai, former Deputy Director General(Fy), ICAR.

Technical Session -3 : Chaired by Dr D.S. Sheshappa, Professor, College of Fisheries, this session covered various aspects of culture and capture techniques. 14 papers dealing with different aspects of culture and capture practices, recreational fishing, ornamental fish production, and harvesting techniques were presented.

Technical Session -4 : This session discussed matters related to Post Harvest Technology. It was chaired by Dr.K. Gopakumar, DDG(Fy), ICAR, and co-chaired by Dr.M.K. Mukundan, Head, QAM, CIFT. 12 papers were presented dealing with processing techniques, biochemical and microbiological aspects, value addition, and quality control in respect of fresh water fishes.

Technical Session -5 : Devoted to Fisheries Extension and Management, and chaired by Dr.D.M.Thampy, Dean, College of Fisheries, Panangad, 16 papers, dealing with strategies for extension, training, management and marketing, for the development freshwater fisheries were presented at this session.

There were lively discussions at all the five sessions. The participants put forth their views, experiences, and suggestions.

Recommendations of the seminar were finalised at the Plenary Session, chaired by Dr.K. Devadasan, Chairman, Organising Committee and Director CIFT, after prolonged deliberations.

Summary of observations and Recommendations

1. Development of a National Code of Conduct for Responsible Fisheries, based on consensus, with special reference to inland resources involving all stake holders, needs to be taken up on priority basis. The Code should be such that it will provide guidelines and standards of behaviour for the conservation and utilisation of inland water resource systems, on a long-term sustainable basis.

2. As inland resource systems have multi-purpose of uses and major impacts, conflicts often arise from activities other than fisheries. This calls for a careful impact analysis which should be mandatory for all non-fishery projects based on inland aquatic resources.

3. Development of comprehensive searchable database on the inland water resources, their fishery, ecological and productivity parameters is an immediate necessity for the management of inland fishery resources.

4. Revalidation of the physical inventory of inland water resources in different States of India needs to be undertaken periodically as an essential requirement for development of this sector.

5. Revalidation of production figures from freshwater resource systems, need to be taken with priority for purposes of resource management and planning.

6. Available inland water resources in different states are not fully utilized for culture-based and/or enhanced fisheries. There is need to orchestrate the optimal use of inland water resources, to reduce supply-demand gap, by increasing fish production.

7. India has an abundance of germ-plasm resources in its aquatic resource systems. However, several endangered and vulnerable germ-plasm resources are identified from different ecosystems, of late. *In situ* and *ex situ* management measures are needed to protect the ichthyo-biodiversity in inland waters.

8. India is blessed with 3.2 million ha of small, medium and large reserviors. The average yield from these reservoirs is estimated at 20 kg. $ha^{-1}.yr^{-1}$. There is agreement among experts that production from reservoirs could be increased to 50 $kg.ha^{-1}.yr^{-1}$ or more, with scientific management and fishery enhancement programmes. Reservoir fisheries need to be recognised as a thrust area for development.

9. Greater focus need to be given for reservoir fishery management based on an ecosystem approach.

10. Cage culture in reservoirs and other freshwater bodies need to be pursued with greater vigour.

11. Introduction of palaemonid prawns (*Macrobrachium* spp.) in reservoirs could increase production, besides adding an attractive export component to the reservoir fisheries economics.

12. Development of post-harvest technologies, value addition and efficient marketing strategies could provide a major fillip to the inland fisheries development. Comparatively low price realized by freshwater fishes and a very weak marketing strategy are recognised as major constraints for the development of this sector.

13. Dams and barrages have been long known to cause physical obstruction to migratory fishes resulting in physiological stress and breeding failures. Inadequate planning before impoundment also leads to difficulties in harvesting of fishery resources later. Pre-impoundment surveys and Environmental Impact Analysis needs to be mademandatory for any project based on inland water resources.

14. Anthropological interventions in riverine and reservoir water bodies have resulted in many deleterious changes in aquatic fauna and flora. While some of these have to co-exist with the developmental activities, remedial measures in the form of artifical habitats for breeding of fish and shellfish can mitigate these changes to some extent.

15. Human interventions have resulted in elevated levels of pathogenic micro-flora in water, sediment and fish. Some of these micro-flora are also resistant to antibiotics. Newer and radical methods of preventing this contamination are the need of the hour.

16. The Geographical Information System (GIS) coupled with satellite imaging techniques can be a powerful management tool for macro-management of riverine and reservoir resources.

17. Selective and environmentally safe fishing gear and practices should be further developed and utilized in order to achieve objectives of maintenance of biodiversity, long-term sustainable production and protection of aquatic environment.

18. Trade in ornamental fishes is recognised as an emerging area with very high export potential, estimated at US$ 30 million. As at present, export earnings are only US$ 0.39 million. Adequate impetus needs to be given for development and promotion of trade of ornamental fishes, on a sustainable basis.

19. India has several indigenous freshwater fishes with potential for promotion in ornamental fish trade. Captive breeding of potential indigenous ornamental fishes in an important area for development.

20. Management of reservoirs by fishermen's co-operatives needs to be promoted, on an experimental basis, in order to increase efficiency of stocking, production and marketing, under governmental supervision.

21. Quality criteria for aquaculture systems and products, need to be developed, on priority basis.

22. A Geographical Information System needs to be developed based on the incidence of biotoxins from algae, fish and shellfish of inland waters.

23. Popularization of freshwater fish, is needed to be taken up, to increase per capita consumption.

24. A national project on development of genetically engineered beneficial species, value addition and quality assurance packages, need to be drawn up.

25. Suitable feed formulations to ensure better growth efficiency, quality and safety of the end product, need to be further developed.

26. The use of indigenous packaging materials for value added products, need to increasingly promoted.

27. A strategy for improving the quality and marketability of smoked and cured freshwater fish products in different parts of the country, need to be developed.

28. There is need for identification of Potential Fishing Areas (PFA) in reservoirs. Remote sensing and application of hydro-acoustics may find extensive use in this field.

29. Appropriate capture techniques such as trawling need to be developed for the removal of undesirable fish species in the reservoirs.

30. The riverine and reservoir systems are controlled by various government bodies. Presently they do not have a uniform policy with regard to fisheries. Any fisheries projects aimed at developing these systems shall be jointly looked into by a Committee having member representatives from various departments. A policy may be evolved in this regard by the government.

31. Training and education of the stake holders with regard to implementation of new regulations and responsible methods of fish harvesting, handling, processing, marketing and utilization in order to attain the objectives of sustainable protection, protection of biodiversity and environmental safety, need to be implemented.

32. Sanctuaries for endangered species need to be established and measures developed to rear them in captivity for fishery enhancement.

33. Practices for proper water, pond and culture management in the aquaculture system for increased and sustained production, need to be implemented.

34. Cage culture and ranching which are found successful in the case of Mahseers may be adopted in various reservoirs. These systems may also be tried with other species.

35. Inland fisheries Extension should be strengthened by adopting non-conventional strategies that were successful in other fields such as cyber extension and precision farming, including participatory approach.

36. Fisheries professionals, local bodies NGOs and fishermen should be encouraged to have greater involvement in social fisheries and in the development of inland fisheries.

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Bait Fishing in Bihar

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Angling is universally acknowledged as a thrilling sport (Jhingram and Sehgal, 1978). The methods employed for angling can be categorised into three main types viz., fly fishing, spoon fishing and bait fishing. Fly fishing is also called fly casting. In fly fishing artificial fly is used as a lure to hook the fish with the help of rod and line. Spoons, like flies, are artificial metallic shining lures used basically to fish 'heavier' waters where mainly mahseer are abundantly available.

Bait Fishing

Bait fishing, also called bait casting, is a popular form of angling for some game fishes. It is a device of landing fish out of water with the help of lure, hook, leader, line and rod. The fishing rods are mostly 1.8 to 2.5 metre long and are made up of tubular or solid metal or of bamboo stick or of split bamboo (Fig. 1&2). The fishing rod in local parlance is known as 'Bansi' which is mostly made up of bamboo sticks or of split bamboo. A vernacular derivative of 'Bansi' is "Lahka" which is angle without and indicator. The bamboo poles are very often being replaced by a long petiole of *Phoenix dactylifera* Linn, locally known as 'Taggi'. A typical local 'Hazara' is a derivative of 'Bansi' which is utilized for fishing on large scale in the Northern parts of Bihar. Each fishing rod goes with a casting reel built to withstand high speed revolutions during casts. Almost all such reels are of quadruple-multiplying-type which implies that they are equipped with a level winding device which distributes the line evenly over the spool as it is wound (Fig.2). The line is relatively light in weight and is of not more than 6 to 7 kg. Lines are made of braided cotton, linen, silk and nylon. The line float is an indicator which in common parlance is designated as 'Tandera'. Its hollow and light texture keeps it afloat on the water surface. It is locally known as "Kandil" or "Kandy" and is made out of *Aeschynomene indica*. It is also prepared from *Schharum arundinaceum* and also from the feathers of peacock (*Pavo cristatus*). These are used during day time.

The float used must be very sensitive while the fishing rod should be light, stiff and short so that it can be cast quickly. Sometimes a little bit of pith or quill less than 3.0 cm long and a straight part of small bamboo tip are used.

Both natural and artificial lures are used in bait casting. The natural lures are more popular in Bihar. The soft-bodied live baits often get separated from the hooks when they are thrown. The natural baits used are earthworms, insects and minnows. The artificial baits are made to resemble real and imaginary aquatic beings and legendary figures like mermaids.

The firefly (*Photinus* spp.) is an important insect for anglers and fishermen alike. This insect is being used as indicator during the angling operations especially under darkness. During night hours the line float (indicator) is often replaced with that of firefly. This bioluminiscent insect is placed inside the glass or plastic container which is made to float on the water surface. The firefly keeps on glowing and the sudden inward pull of the container along with the insect flashes the indication that a fish has been hooked.

In Bihar, bait fishing season commences in July and lasts upto November. The best months are however September and October. The peak period for angling is the monsoon season. During monsoon period the anglers can be seen on the banks of ponds, tanks and wetlands (Fig 3). The best and ideal hours of angling lies in early morning (6.00 to 9.00 a.m.) and during evening (4.00 to 6.30 p.m. till sunset i.e., darkness). A good catch of fish can be obtained practically during the entire daytime. If there are occasional clouds with intermittent drizzles the catch may decrease. Occasional thunderbolts and lightenings scare the fishes temporarily creating some problems for the anglers.

Syed Hasib Ahmed

Types of baits

In Bihar, mostly natural baits of plant and animal origin are being used by the anglers. The baits of animal or plant origin are used in hooked form whereas (Fig. 4) baits of plant origin are also broadcast.

i) *Baits prepared from plants and plant products* : The plant and plant products being utilized as baits are : rice (*Oryza sativa* Linn.) commonly known as 'Chawal', wheat (*Triticum aestivum* Linn.) known as 'Gehum', gram (*Cicer arietinum* Linn.) known as 'Chana', linseed (*Linum usitatissimum* Linn.) known as 'Tisi', caraway or cumin seeds (*Carum carvi Linn.*) known as 'Jira', mustard seed cake (*Brassica campestris*) known as 'Khair' or 'Sarason', dried 'Mahua' (*Madhuca indica*) flowers.

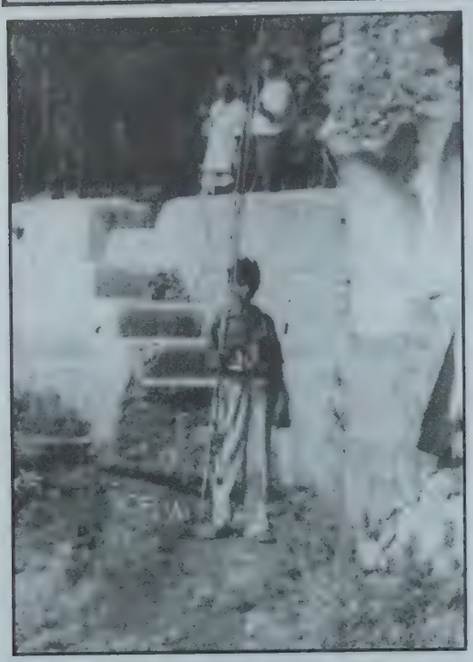

Fig 1. An young boy holding bunch of indigenous fishing tackle and rods standing on the masonary side wall of 'Maner' tank near Patna.

Rice and wheat, the two staple cereals, used in the preparation of baits. Rice is used in roasted, puffed and even in boiled forms. The gram flour known as 'Sattu' is used on large scale as lures and baits. Slices of bread are also occasionally mixed with gram flour and used as bait. Caraway or cumin seeds are also used as bait mixed with wheat flour.

ii) Mixture of cereals and pulses used as bait: Rice, linseed, mustard seed cake are roasted and then ground separately into powder form. These are then mixed together along with the dried powder of the flowers of 'Mahua' (*Madhuca indica*) and the roasted cumin or caraway seeds (*Carum carvi*). Sometimes to the mixture of the above ingredients is added some soil which is squeezed with the help of hands and made into small balls. These mud balls are then cautiously thrown in the shallower areas of the waterbody to lure or signal the fishes.

The powder of lineseed works like a binder and helps the ingredients to stick together for a considerable period of time. 'Mahua' and 'Jira' provide taste as well as flavour to the bait and thus serve as an alluring agents. The powder prepared from the roasted caraway seeds are also mixed with the wheat flour to make the baits. The use of coriander seeds (*Coriandrum sativum* Linn.), known as 'Dhania', and bulbs of garlic (*Allium sativum* Linn.) known as 'Lahsun' in preparing the plant-based bait is also of considerable importance. The mixture of the afore-mentioned ingredients are normally broadcast near the angling site of the waterbody few hours ahead of angling.

Paste Fishing: Paste is one of the most standard bait for Indian major carps; rohu (*Labeo rohita*), catla (*Catla catla*) and mrigal (*Cirrhinus mrigala*). The paste is generally made from finely powdered groundnut (*Arachis hypogaea*) commonly known as 'Chinia badam' or 'Moong phali' and rice (*Oryza sativa*) bran or wheat (*Triticum aestivum*) flour. From the wheat flour stiff dough is made and rolled into small balls. The wheat flour balls are put into a pot containing water set to boil over fire. It is boiled for 15-30 minutes till the same become sticky and agglutinized.

The small balls prepared from wheat flour are taken out, cooked and then kneaded thoroughly, resulting in a stiff white paste. Then some scent imparting material is mixed with the paste. Precautions are always taken to ensure that the consistency of the paste is at a level of stiffness that enables the hook to pierce through it easily. The roasted lineseed, after grinding, is made into powder and

Fig 2. An old man holding fishing rod standing on the embankment of a pond/tank.

Fig 3. Childred engaged in angling from the masonary side wall of a pond/tank

Fig 4. Artificial bat in hook

then mixed with soil in order to have a good earth smelling ground bait. Even mixture of rice bran and asafoetida (*Ferula foetida*), commonly known as 'Heeng' serves as an excellent ground bait for carp fishing, mostly for catla and rohu.

Left-Overs of Whear Flour used as Bait: Some of the homoeopathic mother tinctures such as *Cannabis sativa* and also the essence extracted from some flowers like *Jasminum* spp. and *citrus* spp. are thoroughly mixed with soil and squeezed by hand and made into mud balls. The mud balls containing these extracts are then broadcast at the angling site, a few hours ahead of the fishing schedule. The smell of the essences of the flowers help to induce the aggregation of fishes in and around the specified broadcast site. Now the bait is applied to lure the fishes. It serves as an excellent bait for major carps. Rohu (*Labeo rohita*) is the first to be lured.

Algal Mats used as Bait: Algal mats are collected from the ponds and puddles during the rainy season and used as bait. These algal mats consist of the vegetative stages of the various species of *Oedogonium* spp, *Hydrodictyon* spp. and a few blue green forms of algae. The herbivorous fishes growing in the waterbodies directly feed upon such filamentous algae. Such fishes control the growth of rapidly growing algal mats in the ponds to some extent.

Animal Baits

The animal baits include earthworms, cricket, dragon and stoneflies, larvae of red ants, wasps, honeybees, snails, trash fishes, frogs, tadpoles and spleen of goats and cattle. The entire animal or its selected parts are being used as baits. Notes on animals commonly used as baits are given hereunder:

(i) Earthworm (*Pheretima posthuma*): Earthworms are normally available near the storage sites of cattle dung. The anglers take out the extract of the plant *Polygonum hydropiper*. This plant grows in and around the semi-aquatic habitat of ponds and tanks. The extract is obtained by way of trampling over the plants first and later retrieving the extract. During the crushing operation some water is sprinkled continuously on the plant. This plant extract is generally utilized for procuring the live earthworms from inside the soil as it possesses a strong repelling and fatal effect on the earthworms. It must be having some toxic elements which force the earthworms to come out from their hives. The earthcasts locally known as 'Bhurbhura' are normally found on the top soil close to ponds which helps to locate sites of availability of earthworms. This extract is gradually placed on the earthcasts. As soon as this extract infiltrates and reaches upto the inner layer of soil the earthworms suddenly come out on to the surface. They are then collected and used as bait by the anglers.

(ii) Freshwater prawn (*Macrobrachium lammeri*): This freshwater prawn is abundantly found in most of the seasonal and perennial waterbodies as weed prawn. It is used by the anglers as bait. This small prawn is mostly collected with the help of an herbaceous plant *Croton bonplandianum*, locally known as 'Mirchaiya'. This plant is bushy in nature having lot of branches. The uprooted plants are directly put inside the water column. The prawns take shelter in between the bushy branches of the uprooted plant. The fishermen remove these uprooted plants from the waterbodies. The prawns are collected by giving a jerk to the plants.

(iii)* Mole Cricket *(Gryllotalpa africana): Mole cricket is an agricultural pest causing damage to the cultivated crops. In search of food, mole cricket burrows upto a depth of 20 feet through the soil and destroys the roots of the plants. This insect is nocturnal and found in fields near the ponds burrowing. The mole crickets are collected mostly from the inside of the damp soil in and around the ponds.

(iv) House Cricket (*Gryllus* spp.): The house cricket is nocturnal and omnivorous in habit. It lives in damp warm places, underneath logs, stones etc. It also inhabits places behind books and crevices and also in kitchens. It is also found under piles of decaying plants in gardens, in lawns, and in paddy and wheat fields.

It is one of the most effective baits used by the anglers during the summer and post-monsoon months. These insects are abundantly available during April, May, June and during August-September.

(v) Stone flies (*Rhabdiopteryx lunata*): Stone flies are found near ponds and pools. This insect is not a good flier and so many of them are found resting on shores of pools, ponds and streams. Nymphal forms are aquatic and found mostly hidden under the stones in debris and dead decaying leaves. The adults as well as the nymphs are collected from the shore of the pools and ponds and used as bait. Most fishes devour the same.

(vi) Larvae of red ants (*Oceophylla smaragdina*): The larvae or red ant are collected from their hives which are mostly built on mango and black plum trees. They are available throughout the year. The red ants aggregate together on mango/black plum leaves and build nests. The anglers check the availability of red ant larvae by pushing the hives with the help of long bamboo poles and later collect the same for bait fishing.

(vii) Wasps (*Vespa orientalis*): The larvae of wasps are also collected from the brick crevices of old houses. They are available mostly during the rainy season and used as bait.

(viii) May flies (*Caenis* sp., *Polymitracis indicus*, *Baetis indica*, *B.simplex*): May flies are found in swarms and are abundantly found in ponds and tanks. They are collected very easily for bait fishing.

(ix) Damsel and Dragon flies: Damsel flies are slender and are not good fliers. These insects are also commonly found near ponds, pools, rivers or streams, soon after the rainy season. Dragon flies are abundantly found during rainy season resting on twigs, leaves or grass stalks. These insects and their nymphs are collected and used as baits.

(x) Maggot of house-fly (*Musca domestica*): The female house-fly lays

eggs in masses in stable manure or decaying animal and vegetable matter. The eggs hatch out in a day or two according to variations in temperature; and tiny headless and legless larvae come out of them. The larvae of the fly are popularly known as maggots. These maggots are collected and used as bait by the anglers.

(xi) Gastropods (*Lymnaea spp.* and *Pila globosa*): These include the gastropods; *Lymnaea* spp. and *Pila globosa*. The buccal mass of these molluscs is used as bait. *Lymnaea* spp. is available throughout the year, while *Pila globosa* is abundantly found only during the rainy season.

(xii) Trash fishes (*Puntius* spp.): Small trash fishes like *Puntius* spp. are also utilized as baits. They are mostly collected from the shallow portions of ponds and ditches with the help of indigenously prepared gear, locally known as 'Gang'. The 'Gang' is made up of bamboo and utilized for fishing in shallow water.

(xiii) Air-breathing fish (*Channa striatus*): The fry and early fingerlings of *Channa striatus* are also utilised for bait fishing of large catfishes like *Wallago attu*.

(xiv) Visceral portion of fishes used as bait: The discarded visceral portion of fishes is stored for 2 or 3 days for bacterial decomposition. When foul smell, starts emanating, the material is mixed up with wheat flour and squeezed to make balls. This bait is the favourite of freshwater shark (*Wallage attu*) commonly known as 'Boari' and *Channa marulius*. These fishes are extreme responsive to bite such food.

(xv) Tadpoles of frog (*Rana tigrina*): Tadpoles of frog (*Rana tigrina*) are readily available during the rainy season near the shallower portions of the waterbodies. The tadpoles and frogs too are collected and used as hooked bait.

(xvi) The spleen of goat, sheep and cattle: These are collected from butchers house and used for bait fishing.

Packed Baits

Locally prepared as well as commercially packed baits brought from West Bengal (Kolkata) are available in shops dealing with fishery appliances. The Kolkata-made baits are readily available in most of the medical shops in the district headquarters. These lures and baits and prepared out of a number of medicinal plants which include the rhizomes of *Hedychium spicatum, Acropus calamus* and *Curcuma zedoaria*, root of *Nardostachys jitamasi*; seeds of *Trigonella foenum-graecum, Zanthoxylum alatum, Psoralea corylifolis, Santalum album* and *Carum carvi* and fine wood powder of *Santalum album, Hedychium spicatum* are the major ingredients of this bait combination.

Equal quantities of the plant products are first roasted on a pan and then ground into powder form and later mixed together in equal proportions. The quantum of *H.spicatum* locally known as 'Ekangi' is generally ten times more than the individual weight of each of the constituents. These constituents are thoroughly mixed with the mud and then moulded into balls. These balls are broadcast near the fishing site quite ahead of the fishing schedule. These act as an attractant for fishes and therefore gather near fishing site eventually.

Some essences are available in the markets under the trade name of 'Kachcha Bela' and 'Citronella' respectively. A mixture of essences of some flowers are also available under the trade name of 'Jannat-I-Firdaus' which is also used for bait purpose. The supply of these essences comes from Lucknow (Uttar Pradesh).

Dolphin Oil Used for Alluring Fishes

The oil of freshwater Gangetic dolphin (*Platanista gangetica*) is used by fishermen for alluring the fishes for fishing siluroid fishes like *Clupisoma garus, Eutropichthys vacha, Wallago attu* and *Mystus aor*. The oil is used in combination with gut of goat and dry cattle dung. In another method, a piece of cloth is soaked in dolphin oil and hung at some depth. This is practised in waters at Monghyr, Bihar (Singh and Ahmad, 1994). In both the cases described above the smell of the oil attracts certain species of fishes and this habit of fish is exploited by the fishermen for capturing such fishes.

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Australian Fish Production moves up

Australian fish production in the past ten years to July 2001 increased by 56% in real terms, and exports grew by 102%. In 1999-2000, the gross value of fish production rose to a record A$2.32bn ($1.2bn), it is reported.

This increase represents a 13% growth in value. Export value, including pearls, was 32% upto A$1.99bn ($1.03bn); of which seafood was up 26% to A$1.54bn ($800m).

Both wild fisheries and aquaculture contributed to the 1999-2000 record, aquaculture yielding slightly less than A$700,000 ($363,000).

Source: Seafood International.

NAN RONG

THE NAME OF TAIWANESE PADDLEWHEEL AERATOR

NR-A101 1HP Paddlewheel Aerator

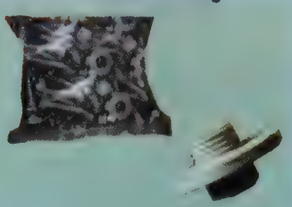
● Spare/Replacement Parts ●

Bearing Cover& Rubber Bushing

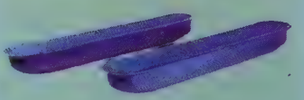
Bearing Stand

Plastic Shaft

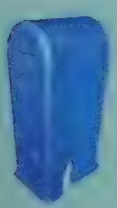
Plastic Frame



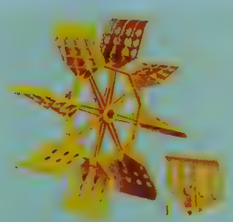
Screw Package & Plastic Nut



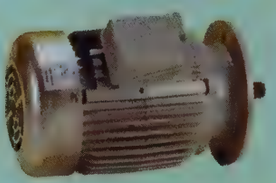
PE Float



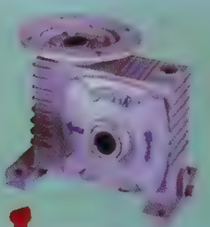
PE Cover



Plastic Impeller



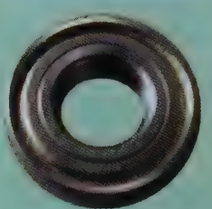
Motor



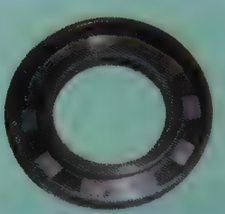
Reducer(14:1)

Motor fan

Reducer Bearing #6306

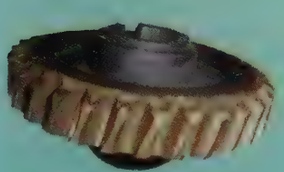


Reducer Bearing #6206



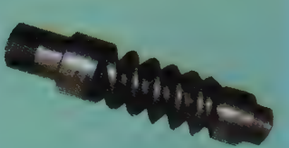
Oil Seal

Output Shaft



Worm Gear Wheel (14:1)

Reducer Bearing #30305



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* Flooding the body of shrimps/fish with oxygen from OXYFLOW boosts oxygen flow in the pond, forces the rapid elimination of harmful gases, therby enhancing growth of better harvest, repairs damaged tissues and improves liveability.
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* Oxidising power of OXYFLOW limits the growth of anaerobic bacteria and reduces harmful effects of toxins, keeps the pond fresh for growth and improves harvest.
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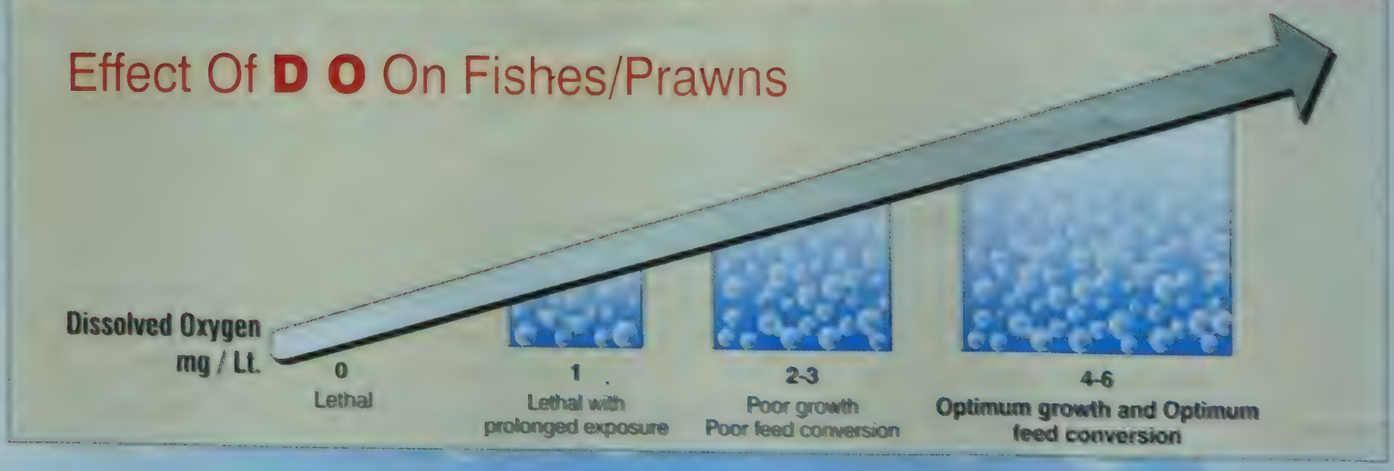

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SWOT Analysis of Indian Marine Fishing Industry

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India's seafood industry has to make faster strides to catch up with the global trends in the sector. Apart from ensuring high quality standards, promotional efforts have to be stepped up enormously to register the needed level of progress in the exploitation of high sea pelagic resources of Indian Exclusive Economic Zone and oceanic demersal stocks, and in respect of value-addition to exploited stocks, so as to boost exports of marine products to overseas market.

Indian fisheries constitute an important sector of our national economy for various reasons. The importance of this sector can be better appreciated in the light of the fact that it provides wholesome healthy food containing animal protein in the diet of of the country's undernourished population. Despite achieving marginal surplus in food grains production, the problem of protein deficiency in diet continues to be acute. India's share of protein production out of global output is placed at 4.3 per cent as against 15.3 per cent in the case of China, the leader in fish production (Table-1). India's position continues at the same level (Table-2). This indicates the need for augmenting fish production. In this context, considering the high protein value of fishes, development of fisheries has been receiving considerable attention of Indian government.

Indian fisheries, according to the national income statistics, contribute to about 2.4 per cent of the gross domestic product (GDP) and 4 per cent of the income from agriculture sector. The estimated fishery resources, both inland and marine, are capable of yielding 10 million tonnes of fish per year. Against this the present annual production is 5.6 million tonnes (Table-2). Development of fisheries, considering the available extent of resources, can play a significant role in increasing fish production and there by the national income. Foreign exchange earnings from export of fish and fishery products, with adequate facilities provided, have been estimated to be capable of being stepped upto twice that of the present earnings, in the years to come. The fishing industry, has generated and strengthened a large number of ancillary industries and it will continue to strengthen them. Thus, the development of fishing and allied industries has a special significance, on account of the following:

Table 1. World fish production ('000 tonnes)

Country	*1998*	*1999*	*Difference*
China	17,229,927	17,240,032	+0.06%
Peru	4,338,437	8,429,290	+94.29%
Japan	5,263,384	5,176,460	-1.65%
Chile	3,265,383	5,050,528	+54.67%
Russian fed.	4,454,759	4,141,157	-7.04%
U.S.A.	4,708,980	4,749,645	+0.86%
India	3,214,765	3,316,815	+3.17%
Indonesia	3,964,897	4,149,420	+4.65%

Source: Fishing Chimes Vol 21 No. 3 (June 2001)

a. It is eminently suited for the upgradation of the socio-economic status of the weaker sections of the rural community,

b. It provides a large quantity of proteinacious food at reasonable prices to satisfy certain rigid consumer preferences, and

c. It has a large export potential. Besides, fishes are very rich in vitamins (A, D and E), protein, carbohydrate, iron, calcium and other minerals. In one pound of fish the food value comes to be 300-600 calories. This is much higher in comparison to other food materials of human consumption.

The fisheries of India constitute (a) marine fisheries and (b) inland fisheries. Of the total fish produced in the country about 50 per cent is contributed by marine fisheries and the inland fisheries make up the remaining (Table-2). If the fishery sector in general has to be developed in the country, development of the marine fisheries sector in particular becomes necessary. With this in view an attempt towards analyzing the strengths and weaknesses of this sector and its export potential has been made.

SWOT Analysis

Before going into details of SWOT analysis of Marine Fish Industry of India, a brief account of what SWOT analysis is and what it signifies becomes necessary. An attempt is made hereunder in this direction.

For an industry or enterprise to flourish, analysing its strengths and weaknesses, and in that light working out a proper plan towards developing that particular industry or enterprise is essential. This is possible only when we take into consideration the threats/constraints, while also identifying the opportunities available too, so as to take them into account in working out a proper plan. SWOT analysis plays a major part in this process. The letters in the acronym SWOT denote Strength, Weakness, Opportunity and Threat respectively.

Significance of SWOT Analysis

SWOT analysis of any given industry/enterprise therefore, would help us in:

a) in providing a basis for future action,

b) in decision making process,

Table 2. Indian Fish production 1999-2000 (in tonnes)

S.No.	States/Uts	Marine	Inland	Total
1.	Andhra Pradesh	166482	380580	547062
2.	Arunachal Pradesh	0	2395	23951
3.	Assam	0	159768	159768
4.	Bihar	0	254740	254740
5.	Goa	62113	3509	65622
6.	Gujarat	670951	70328	741279
7.	Haryana	0	30000	30000
8.	Himachal Pradesh	0	6995	6995
9.	Jammu & Kashmir	0	19010	19010
10.	Karnataka	165653	126846	292299
11.	Kerala	575600	73900	549400
12.	Madhya Pradesh	0	127429	127429
13.	Maharashtra	397901	135390	533291
14.	Manipur	0	15506	15505
15.	Meghalaya	0	4676	4676
16.	Mizoram	0	2890	2890
17.	Nagaland	0	5000	5000
18.	Orissa	125935	135303	261238
19.	Punjab	0	47177	47177
20.	Rajasthan	0	12968	12968
21.	Sikkim	0	140	140
22.	Tamilnadu	363000	112000	475000
23.	Tripura	0	29340	29340
24.	Uttar Pradesh	0	192714	192714
25.	West Bengal	180000	865700	1045700
26.	Andaman & Nicobar	28147	56	28203
27.	Chandigarh	0	2	2
28.	Dadra & Nagar Haveli	0	29	29
29.	Daman & Diu	15946	0	15946
30.	Delhi	0	4300	4300
31.	Lakshadweep	13600	0	13600
32.	Pondicherry	38620	4210	42830
33.	Deep Sea Fishing Sector	30000	0	30000
	Total	**2833848**	**2822701**	**5656549**

Source: Fishing Chimes, Vol. 21 No. 3 (June 2001)

essary to study from the scratch what opportunities may arise during this century, by examining what the strengths and weaknesses are and in that light work out a strategy that will meet the social, economic and nutritional needs of this country.

Strengths

a. Strong resource base: India is blessed with rich marine fisheries resources. It has a vast coastline (8129 km), and enjoys a generally conducive tropical climate. India has an Exclusive Economic Zone of 2.02 million sq. km. and a continental shelf of 0.5 million sq. km, with an annual yield potential of 3.9 mill. t. There is a brackishwater area with an extent of 1.2 million ha and an annual yield potential of 0.6 million t. There are 3.2 million ha of reservoirs, several natural lakes and 2.25 million ha of inland freshwater lentic waters.

b. Low labour cost and skilled labour: A major share of the total fish produced in the country comes from the traditional sector. The workers / fishermen come from traditional labour class and they are available for work at low wage rates. Such is not the case in most parts of the world. Apart from low wage rates Indian workers include skilled personnel, mostly women, who can peel shells of even the finest of shrimps with ease and no wastage.

c. Employment generation: The potential in this respect is a strength as well as an opportunity. Strength, in the sense, that the industry employs several millions of people directly and many more indirectly in related industries. Of the six million fisher population in India, 1.5 million are active fishermen. (Table-3).

The potential throws opportunities too. The sector has the potential of creating employment opportunities and this motivates the government develop this industry.

d. Strong base of scientific institutions: The fact that there are several fisheries research institutes such as CMFRI, CIFT, etc. in the country connotes that the fisheries industries have a strong scientific base. The research and development works carried out at these institutes are target-oriented, contributing to overall development of fishery industries.

e. Low cost effort: Indian fishing effort is predominantly traditional and antisanal in nature. With several non-mechanised fishing boats continuing to be operational and the wages continuing to be on the lower side, the activity, in general terms, has to be considered as based on low-cost effort. Further, low cost effort, has attracted a large number of rural-based

c) in providing a proper feedback i.e., it provides information as regards the actual performance and the steps to be taken for its improvement,

d) in setting up standards of performance,

e) in taking up vision based research to convert weaknesses into strengths and constraints into opportunities, and

f) altogether it helps for the smooth operation of any industry or enterprise.

In the absence of a publicly announced long term policy on development of India's marine fisheries, it is nec-

Table 3. Marine Fisheries Resource Potential of India

Item	Extent
Coastline	8129 km.
Exclusive Economic Zone (EEZ)	2.02 mill.sq.km
Continental shelf	0.5 mill.sq.km
Annual yield potential	3.9 mill.tonnes
Total marine fisher population	6 mill.
Active marine fishermen	1.5 mill.

Source: Statistical Bulletin of Fisheries, 1997

enterprises to venture into this industry for a living.

Weakness and Problems

a. ***Infrastructure facilities***: The inadequacy of infrastructure facilities right from landing of catches to the shipment stage tends to be a major constraint in the way of post-harvest activities including export endeavour. India possesses around 360 fish landing centres in all, including both traditional and modernized centres (Table-4). Apart from these, there are 72 freezing plants, 14 canning plants, 450 cold storage units and 900 peeling sheds. These are far less compared to the abundant resources available in the EEZ of the country. Further, the service facilities provided are inadequate right from landing to marketing. Lack of insufficient information on demand and supply also hinders market development.

b. ***Design and construction of boats***: Most of the crafts and gears used in Indian coastal waters are designed for oar/sail propulsion. These systems confine the operations to near-shore waters and the off-shore and high sea zones are not within the range of accessibility of these crafts. Consequently, bulk of the resources beyond the coastal zone are inadequately exploited. The other factor of concern is that the Indian ship building yards are practically starved of orders for the supply of fishing vessels. In contrast, shipyards of advanced maritime nations, with far lesser resources compared to Indian EEZ, have their order books for construction of fishing vessels fairly filled in.

c. ***Policy gap in respect of joint ventures***: Absence of proper government policies related to promotion of joint ventures between Indian and foreign companies known to have proven capabilities in the development of marine fisheries industries is a factor that discourages private sector companies to take up integrated venture activities, aimed at exploiting resources such as tuna, and imparting value addition to various products. This is one area where government has to formulate policies and strategies for utilising the availabe resources for national benefit. The sooner the shrimping activity is restricted to the small scale sector and processing and export to the existing ownership of related processing plants, and the high sea and ocean fishing is brought under corporate orbit with needed policy and strategy support, the better it would be for the nation.

d. ***Database on resource availability***: Adequate data on the resources available in Indian EEZ is available with FSI and CMFRI. The problem, however, is that it is not passed on to the investors in the format of a project outline for them to evaluate and proceed further. Just telling about the qualitative and quantitative aspects of the resource would not enable the industry to take investment decisions and mobilise funds.

Opportunities

a. Untapped resources base: The main fishing effort in Indian EEZ is concentrated in near-shore waters. The result is that this leaves the off-shore and deep sea resources unexploited, which, if tapped, can be helpful in catapulting India to a much more prominent place in the world fish production. The nation has the potential to be one of the few top fish producing countries of the world.

b. ***Rapidly growing domestic and worldwide demand***: The problem of protein deficiency and malnutrition has resulted in a great increase in the demand for marine products, as they are a cheap source of protein both in domestic as well as the world market. This creates opportunity to harvest even low value fishes, for adding value later for securing attractive and viable returns.

c. Product and Market Diversification: India exports its marine products to various countries. However industry is

Table 4. Infrastructure available in India (as in Dec '99) (Nos.)

Entity Name	*Regd.as on 1st of Month*	*Pend. Appns. on 1st of month*	*During the month*		*Nos. Regd.*	*Nos. Deregd. during the month*	*Pending Appns at the end of month*
			Appns Received	*Appns Rejected*			
Freezing plant	393	20	2	0	3	0	19
Canning Plant	13	0	0	0	0	0	0
Agar Agar	4	0	0	0	0	0	0
Isinglass	1	0	0	0	0	0	0
Ice Plants	160	5	0	0	0	0	5
Fish Meal Plants	12	0	0	0	0	0	0
Peeling Shed	562	12	5	0	7	1	12
Conveyances	494	32	0	0	0	0	32
Cold Storage	477	22	3	0	3	0	22
Other Storage	216	6	0	0	0	1	7
AFD Plant	3	0	0	0	0	0	0
Surimi Plant	5	0	0	0	0	0	0

Source: *Fishing Chimes* 2001 Vol. 20 Nos. 10 & 11. (Jan/Feb)

Table 5. Share of shrimp in total marine products export

Year	Total exports		Shrimp component		% Share	
	Qty. M.tonnes	Value Rs. Crores	Qty. M.tonnes	Value Rs.Crores	Qty.	Value
1998-99	3,02,934	4626.87	1,02,484	3344.91		
1999-00	3,40,003	5095.73	1,09,868	3635.01		

Source: *Fishing Chimes*, Vol 20 No. 10 & 11 (Jan/Feb)

heavily dependent on a single product (shrimp) and on a single main market (Japan) for its exports. Japan's market share of Indian shrimp has been increasing over years, and it is now 65% of the total exports (Table 5). This high level of exports can generate scope for product diversification (value addition) and diversification of market as well. This scope can be realised through a proper policy option.

Threats

a. High energy cost: With mechanization taking place rapidly, the spiralling diesel oil cost has emerged as the most disquieting threat to this industry. It is apprehended that this phenomenon may set in motion a trend towards unemployment, as the boats stop operating because of financial losses.

b. Defence threat: Another threat to this industry comes from large competing countries and also neighbouring countries. Our vulnerability (absence of the needed fleet to exploit high sea pelagic resources and deepsea oceanic resources) will trigger the revival or strengthing of the dreaded trend of foreign vessels poaching in our EEZ posing a defence threat or security problem.

c. Overfishing of commercial varieties: Overfishing of commercial varieties may render these endangered, moving towards extinction. This is believed to be happening presently with certain species of shrimp. The trend can be stemmed through introduction of ranching programmes and through programmes to encourage fishing of low valued species, and subjecting them to value addition for higher price realisation.

d. Sanitation and hygienic conditions: There is need for improving sanitary conditions at all the stages right from harvest, through storage and shipment for external markets. Upgradition of sanitary standards is very crucial. If this is not done, there can be the serious possibility of the exported products being rejected by the importing nations.

Suggestions and Conclusions

The fishing industry of India has made several strides in the commercial sector, and will continue to move forward in the coming decades. In this context, it is imperative that the objectives of food security supply, income and employment generation and export earnings are also planned to move apace. In order to reach the targets for increased production, consumption and exports, developmental efforts by the government should focus on the following activities during the years to come:

i. Designs of fishing systems on traditional crafts to be further improved.

ii. Fishing activity to be diversified on mechanised boats so as to enable fishermen to exploit the resources in an effectively judicious manner.

iii. Infrastructure facilities in areas of handling, processing and distribution to be improved and augmented.

iv. Product diversification including value-addition to be brought about.

v. Financial assistance to be extended to the entrepreneurship to keep pace with the rapid developments taking place in the sector.

vi. Enlightened fishery management both of the assets and of fishing work in all its aspects to be made an important part of the developmental activities, effectively linked to research and development, quality specifications and the market development, and

vii. Legal basis to settle disputes between the employer and employee needs to be established.

If the developmental strategy is planned keeping in view the above mentioned points, we can be confident of achieving the targets set up for the coming years. Policy makers have to be prevailed upon with appropriate suggestions to formulate effective policies for the industry to flourish.

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Karnataka CRZ Management : Forest Department may be the Choice

A Committee appointed by the Karnataka High Court to look into violoations of the Staes CRZ, it is reported to have suggested physical demarcation of CRZ on the ground and on village maps. It is reported to have also recommended that all available Government and in the Coastal stetch of 500 m and in the zone of tidal effects where CRZ notification would be applicable may be handed over to the forest department for future management.

Read Fishing Chimes

SANTIR AQUATIC's *Unique Initiative.....*

Sets up Captive PCR Lab at its Shrimp Hatchery

------- *Inaugurated by MPEDA's Chairman, Jose Cyriac on June 26, 2001*

Santir Aquatic Private Ltd, Visakhapatnam, has earned the distinction of being the first company to set up a captive PCR Laboratory, fully integrated with the maturation facility, at its hatchery, located on Uppada Beach Road, near Kakinada in Andhra Pradesh. It may be mentioned here that the shrimp hatchery of Santir Aquatic Pvt. Ltd., was set up with the assistance of the World Bank.

The PCR Laboratory was inaugurated by Mr. K.Jose Cyriac, Chairman, Marine Products Exports Development Authority (MPEDA) on 26 June, 2001. A microbiological testing facility was also made integral to PCR Lab, and this was opened by Mr. D.S.Murty, Commissioner of Fisheries, Government of Andhra Pradesh.

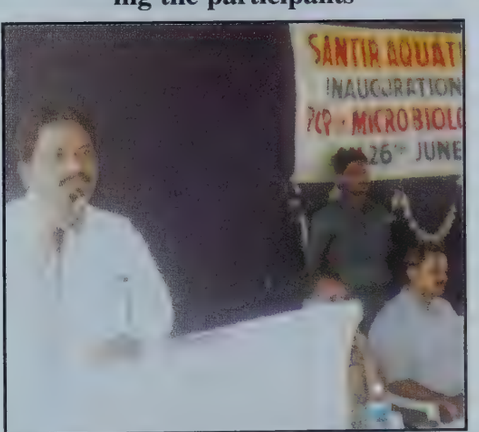
Several fish farmers, exporters, members of Andhra Pradesh Shrimp Hatchery owners Association, Mr. Ganta Srinivasa Rao, M.P., Mr. Yenemala Krishna, Mandal President, and those representing various allied activities participated in the inaugural function held in the hatchery premises of Santir Aquatic.

Mr. M. Sudharshan Swamy, walking in step with Mr. Jose Cyriac, Mr. Ganta Srinivasa Rao, M.P. and Mr. D.S. Murthy, Commissioner of Fisheries A.P. after receiving them.

Dignitaries on the dais. Mr. K.V. S. Prasad, Vice-President A.P. Hatchery Owner's Association is at the podium.

Mr. M.Sudarshan Swamy, Managing Director of Santir Aquatic and President of A.P. Hatchery owners' Association welcomed Mr. Jose Cyriac, Chairman, MPEDA, Mr. D.S. Murthy, Commissisoner of Fisheries of Andhra Pradesh, Mr. Ganta Srinivasarao, M.P., Mr. Yenamala Krishna, Mandal President, the Members of the A.P.Hatchery Owners' Association, prominent among whom were Messers.Kondala Rayudu, KVS Prasad, Venkateswara Rao, Srinivas, Bhaskar and Mallibabu, and several exporters of marine products. Mr.Sudarshan Swamy thanked Mr. Jose Cyriac for acceding to his request to inaugurate the PCR Laboratory, and coming all the way from Cochin, despite his busy schedule. He thanked Mr.D.S. Murty for his gracious presence. He also expressed his

Mr. M. Sudharshan Swamy welcoming the participants

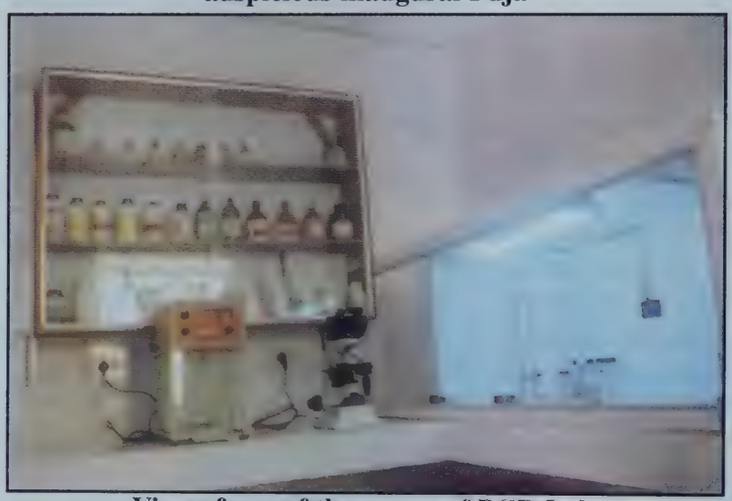


Mr. Ganta Srinivasa Rao addressing the participants

Mr. Jose Cyriac delivering inaugural address

Mr. & Mrs. Sudharshan Swamy performing the auspicious inaugural Puja

View of a section of participants



View of one of the rooms of PCR Lab

Participants during lunch break

Mr. D.S. Murthy speaking on the occasion

gratitude to him for his intervention in bringing the hatchery under the purview of World Bank - assisted hatchery scheme and helping his company to secure funds from World Bank for setting up the hatchery through the fisheries department. Extending special thanks to Mr.Ganta Srinivasa Rao for his participation, he highlighted his relentless efforts for the well being of shrimp hatcheries and for lending support to the genuine representation of shrimp hatcheries before the concerned authorities of the government of India to reduce the import duty on Artemia. He added that Pratyusha Hatchery at Ongole in Andhra Pradesh, under his guidance, had become a trend setter to the other hatcheries. His special thanks went to Mr. Yenamala Krishna too.

Sudarshan Swamy applauded the professional skills of shrimp hatchery operators of the State. Despite various hazards they faced, they could achieve significant improvement in the quality of shrimp seed produced at their hatcheries. He apprised the Chairman and various participants that the seed production this year at the hatcheries had been far better compared to the production level of previous year. Observing that the survival rate of shrimp seed supplied by the hatcheries to the various shrimp farmers had improved enormously, he lamented that the main problem faced was the drop in the selling price of seed, because of fall in export prices of shrimp. He said that there was relief among farmers that quality of seed produced at the hatcheries and supplied to them had improved considerably. The PCR Labs at various centres confirmed the disease-free quality of majority of samples.

Sudarshan Swamy brought to the notice of the Chairman, MPEDA the problems faced by the hatchery owners in respect of securing broodstock of shrimps. Presently hatcheries were forced to obtain brooders/nauplii stock from several areas, starting from Rameswaram in the South to Balasore in the North, depending on the season and availability. Long distances over which they had to be transported caused severe stress to the broodstock/nauplii and this posed the problem of maintenance of quality of the post larvae. It was mentioned by Swamy that 100% disease-free post larvae could be produced only when the Government

provided needed infrastructural facilities for the production and supply of domesticated broodstock that would be of SPF (specific pathogen free) quality. He added that only when such a project was taken up and implemented could the hatchery be in a position to supply 100% disease-free shrimp post-larvae consistently to the farmers. He appealed to the authorities to strengthen the on-going project taken up by CMFRI to produce domesticated broodstock of tiger shrimp, if necessary as a joint venture with a group of hatcheries or with A.P. shrimp hatchery owners association for intensifying the research work on the subject. He expressed unhappiness that the hatcheries were being blamed for the depletion of wild tiger shrimp brooders. It was explained that the hatchery owners had no special fascination for the wild shrimp broodstock, but they had no other alternative. They were as keen as the authorities to give up their dependence on wild shrimp brooders. He hoped that this dependence could be extinguished once domesticated shrimp broodstock production technology was standardised and extended to commercial farms to enable them to develop SPF broodstock of tiger shrimp for supply to various hatcheries.

The Managing Director of Santir Aquatic told the participants that in countries such as Thailand, New Caledonia and USA (Hawai), it had become a routine practice to produce domestic tiger shrimp broodstock of SPF quality and supply them to hatcheries. In fact, in US the availability of such broodstock was advertised for the benefit of hatchery owners. It was also mentioned that IFREMER, a French organisation that had developed this technology had been able to produce 8th generation of domesticated tiger shrimp brooders. The development of this technology was accomplished in most of these countries in private sector. Recalling that MPEDA had brought the shrimp hatchery technology from USA and France to India, he said that it would be befitting for the Authority to intervene and ensure that the domesticated broodstock production technology was developed within the country or imported as an alternative from one of an countries mentioned above for the development of domesticated broodstock. He added that unless this was done on top priority, the present problem being faced by the hatcheries would not only persist but would become even worse. He mentioned that conditions were turning out to be adverse even for harvesting of wild tiger shrimp brooders.

It was mentioned by Swamy that there had been a significant shift in the world shrimp market as the demand had moved from larger to smaller sizes due to cost factor, and this was related to recession in Japan and USA. This shift might prompt the farmers to increase the stocking density and also harvest early, as the demand from external markets was for the smaller sizes. This emerging trend would realign the role of shrimp hatcheries to produce and supply larger quantities of shrimp seed to the farmers. In this scenario, he highlighted the vital importance of stepping up and maintaining quality of shrimp seed supplies by the hatcheries for their survival. He said that it would be possible to achieve these only by stepping up quality of management, which would be possible only having supplies of quality broodstock/nauplii, and adequate stocks of feeds such as Artemia.

While speaking on the observance of code of practices stipulated by MPEDA to the hatcheries, Swamy highlighted the crucial importance of PCR and microbiological laboratories. He said that these laboratories, as additions to hatcheries, would improve the quality of the shrimp seed produced and would help the hatcheries to be of enhanced service to the farmers. Pointing out that there had been awareness in respect of the quality of seed among the farmers, it was observed that until last year no farmer or shrimp nursery owner demanded quality testing of seed samples. He added that now a major change in the approach was noticed. Around 15% of the seed taken delivery of was being subjected to tests by the farmers and nursery owners for WSSV or MBV through PCR. It was pointed that as nurseries were not being maintained as hygienically as needed, there were fears of virus contamination of seed at the nurseries. Consequently farmers were being very careful in buying seed from nurseries, mostly in the West Godavari District of A.P. He told the participants that, in this context, Santir Aquatic had now organised supply of 100% PCR negative tested seed from four nursery ponds run at (a) Ganapavaram by Mr. Sattibabu, (b) Mahadevapatnam by Mr. Subhash, (c) Karla and (d) Losari by Mr.Subbarao. The farmers who stocked their farms with the seed taken from these four nursery ponds and also from other associated nursery ponds had reported very good results. These results had motivated Santir Aquatic to multiply the system for the benefit of a larger number of farmers. He said that Santir Aquatic would now be switching over to testing of the seed at their own PCR Lab. He thanked MPEDA for providing a subsidy of Rs.5.00 lakhs towards the cost of equipment that had been installed.

Pointing out that the expenditure incurred on Artemia, the feed mainly used for feeding growing larvae at the hatchery, constituted a major chunk of recurring costs and owing to the persistent efforts of the Association to prevail upon the Government to bring down the oppressive duty on Artemia which pushed up the price, Sudarshan Swamy said that the matter of reducing the duty was now receiving favourable consideration in the Union Revenue department. Resolution of the issue could progress to this encouraging stage because of recommendation of MPEDA, Fisheries Division of the Union Ministry of Agriculture and above all owing to the intervention by Union Minister, Mr.Yerram Naidu and Mr.Ganta SrinivasaRao, M.P. He expressed the hope that Mr. Srinivasa Rao would pursue the subject to its logical end in the finance ministry so as to provide the much needed relief to the hatchery owners, and indirectly to the farmers. He hoped that the duty would be scaled down to 5%.

Certain little known facts in respect of levy of market cess were related by the President. He startled the majority of the participants that, without providing a marketing yard or any other such facility, marketing cess was being collected at 5% by the State Government, suprisingly thrice, once at broodstock level (at the time of purchase of brood stock at the landing point), another time at the hatchery when eggs of brooders were supplied at PL stage to farmers, and again when the PLs, in grown form as adults were exported. He appealed to the Commissioneer of Fisheries, A.P. to apprise the state government of this anamoly in the levy of market cess and recommend its abolition.

Sudarshan Swamy also appealed to the authorities to set up common waste water effluent treatment systems, one for each cluster of three to five hatcheries. He said that this was a must for maintaining water quality. The establishment of these systems would help in the treatment of effluents before their release into the sea. He also pleaded for help in ensuring facilities for the farmers in respect of transportation of ice to farm sites and for transportation of harvested shrimps to centralised cold storages which would have to be set up with MPEDA's help. Processing facilities also would have to be augmented for which financial and other help would have to be forthcoming from the government.

Concluding, Sudarshan Swamy exhorted all the hatchery owners and farmers to participate in the forthcoming Shrimp 2001 event to be held in Chennai from 27 to 29 Sept. 2001.

In his inaugural address, Mr. Jose Cyriac, Chairman, MPEDA, congratulating Mr. Sudarshan Swamy for adding PCR Lab to Santir Aquatic's hatchery, said that the setting up of PCR Laboratories as part of the hatcheries was essential, particularly to comply with the code of practices formulated by MPEDA for the production of healthy shrimp seed at the hatcheries. It was mentioned by him that, though it was not compulsory for hatcheries to adopt the code, the owners would be well advised to do so to instill confidence among farmers that they would be receiving disease-free post larvae of shrimp from hatcheries for stocking their ponds. He made it clear that, in future all aid to hatcheries from MPEDA, financial or otherwise, would be linked with the code of practices. It was pointed out that it would cost around Rs.10 lakhs to set up an inhouse PCR laboratory and that MPEDA would provide a subsidy upto Rs.5 lakhs thereof. With the laboratory available at the hatchery itself it would be convenient to have the tests of post larvae conducted for white spot virus or other viruses then and there and this would give enormous confidence to the farmers, he explained.

The Chairman told the farmers that their operations would become secure and they would stand to gain once they have their farms registered with the Aquaculture Authority of India. He exhorted the farmers to apply to the Authority through the state fisheries department for issuing the needed licences. Licences of this nature would eliminate the risk of demolition of their farms. Although there were over 50,000 farmers in Andhra Pradesh, only a few hundreds of them had obtained licences so far.

The Chairman gave the good news to the farmers that MPEDA was now processing a subsidy scheme for setting up hatchery effluent treatment plant and that the Aquaculture Authority of India had already finalised the design of a model effluent treatment plant.

Jose Cyraic also told the farmers that, once they were registered with the AAI, the insurance companies and commercial banks would develop confidence and come out to extend the needed assistance.

The Chairman mentioned that culture shrimp production during 2000-2001 was of the order of one 1,13,000 tonnes as against 86,000 tonnes in the previous year. He was apprehensive that production and earnings this year might suffer a marginal slide because of lower prices but he expressed the confidence that the production would still exceed one lakh tonnes.

Mr. Ganta Srinivas Rao, M.P. assured the participants that he would extend all needed help in solving the problems of aquaculture by taking up the issues with the Government. He had also emphasised the need for setting up of PCR Laboratories at the hatcheries.

Mr. D.S. Murthy, Commissioner (Fisheries) Andhra Pradesh exhorted shrimp farmers to obtain licences from Aquaculture Authority. He said that they need not nurture any apprehensions that they would be penalised or harassed on some ground or the other once they had applied. He advised that they could mention in their application forms that they were practising only "improved or modified traditional culture" which they were actually practising. He clarified that the order of the Supreme Court on the subject allowed these types of culture too. He said that, if the stocking density was less then 60,000 nos of post larvae per ha., the activity could be categorised as "modified traditional culture" and farmers need not have any fear, he added.

The function came to a close with a vote of thanks by Mr. K.V.S Prasad, Vice-President, A.P. Shrimp Hatchery Owners Association.

Godrej Aquavet enters Aqua feed sector in Big Way

Godrej Aquavet limited has established a sophisticated feed plant in association with Tai Aqua Company, Taiwan at Chennai. The plant conforms to ISO 9002 standards. Shrimp feeds for modified extensive (Hoshu Brand), semi-intensive (Kohachi Brand) and extensive (Fuso Brand) are manufactured at the plant.

The company conducted on 17th July 2001Seminars at Kakinada and Amalapuram in E.G.Dist of A.P. at which presentations were made in respect of the feeds for the benefit of the farmers, who participated in the Seminars in large numbers. Mr. A.V. Arun Subbiah, Sales Manager of the company, Mr. Bor-Yu le of Tai Aqua Company spoke at the Seminars. The participating shrimp farmers obtained clarifications from Mr. Arun Subbiah and Mr. Bor-Yu le in respect of sustainable and healthy shrimp aquaculture.

Some aspects of fishery, biology and conservation of a Peninsular carp, *Puntius pulchellus* (Day)

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Some aspects of biology and fishery of the endangered carp of peninsular India, *Puntius pulchellus*, (Day) such as habitat, breeding and feeding habits were studied. The studies have revealed that *P. pulchellus* is herbivorous but changes its feeding habits depending upon the availability of food in the habitat. It utilizes soft vegetation like *Vallisneria, Chara, Hydrilla*, etc. in the habitat. The males above 230mm and females above 220mm attain maturity after two years of age. The breeding season of the fish extends from early monsoon to late monsoon in the Deccan Region. One group of the matured ova is released during mid-June to August, and the remaining in the early part of November.

The changing ecology of water bodies, natural and man-made, have a direct impact on the fish fauna. The construction of dams, anicuts, barrages, pollution, indiscriminate exploitation of riverine fisheries, and lack of conservation and stocking measures have forced many native fishes of Peninsular India into an endangered status. *Puntius pulchellus* (Day) is one of the important fish fauna of Deccan Region of India prior to the construction of Tungabhadra Reservoir in 1943 (Menon, 1988). During 1964-65 this species had contributed 1% towards the total fishery of the Tungabhadra river systems (David *et.al.*, 1969). But now,due to several factors, this species is rarely found in river catches.

The objective of this study was thus to ascertain the present status of the fish, which was available in the river system before the construction of the dam but had become endangered in over five decades of its impoundment. In view of the sharp decline in the fish population, the present studies aimed at the biology of the fish for its artificial propagation to save it from extinction. The authors took up studies on the fishery and biology of the fish at various intervals in between December 1995 and December 1997. To start with examination of both adult and juvenile specimens was done to ascertain its feeding habits from the river pools and the river stretches.

Materials and Methods

The live fry, fingerlings, juveniles and adults of *P. pulchellus* were collected from five riverine spots from Tunga and Bhadra river systems and from two fish markets (dead specimens) of Karnataka (Shimoga and NRpura). The riverine stretch covered was from Sringeri (river Tunga) upto Bhadrawati dam site and below the dam site at Shimoga extending to about 300 km (Fig 1), upto Tungabhadra reservoir. The data related to pre-monsoon (April-June) and post-monsoon (October-February) periods were pooled and the results were discussed. Though the data were collected at intervals (due to the scarce availability of species) a correlation was attempted with reference to earlier observations on various biological aspects.

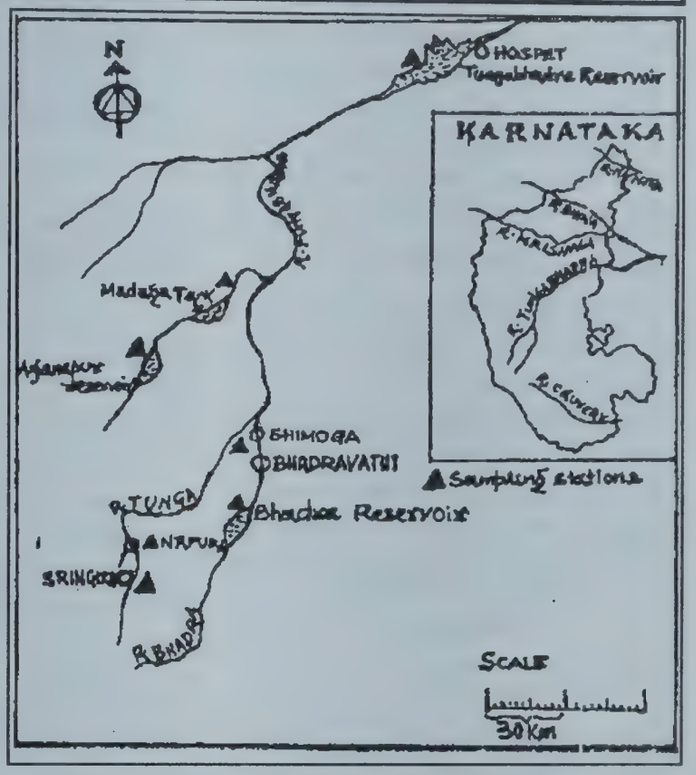

Fig 1. Sketch map of the sampling sites along the Tungabhadra river

Results and Discussion

Puntius pulchellus as a Peninsular carp has several synonyms like *Barbus pulchellus* (Day, 1878) and *Barbus jerdoni* due to the presence of almost similar characters of fin and scale except for colouration. David (1966), after detailed study of the specimen collected in Godavari and Krishna rivers, had indicated *P. pulchellus* as a synonym of *Barbus dobsoni* and *Barbus jerdoni*. Talwar and Jhingran (1991) mentioned the species with two different synonyms like *B. jerdoni* / *B. dobsoni* and *Barbus pulchellus*. The identifying characters of this species includes deep body, 2.5 to 3 times of which is equaly to standard length. Mouth is narrow having two pairs of barbels. The maxillary pair is equal to the orbit and the rostral pair is slightly shorter. The number of lateral line scales are 26-32 and the predorsal scales are 12.

Present status

Prior to construction of Tungabhadra Dam the availability of the fish was significant in the Tungabhadra River system. This species is recorded from all the three major rivers of Deccan and Peninsular India and it formed a fishery in Tungabhadra river prior to construction of T.B. Reservoir in 1943 but the declin-

ing trend, even less than 1%, was reported during 1964-65 (David *et al.*, 1969). A maximum size of 780mm weighing 8.0 kg was recorded in river Cauvery (David, 1969). At present, out of the total monthly fish arrivals, hardly 1 or 2 numbers of pulchellus are seen. The reasons for depletion in the population of the fish may be attributed to indiscriminate killing during pre-spawning period when migration takes place to shallower waters for breeding. In summer months, most of the fishes are kept confined to major river pools and sanctuaries (natural).

The habitat

This species is available in the Deccan rivers namely Tunga, Bhadra, Tungabhadra, Krishna, Cauvery and Godavari (David *et al.*, 1969). During the course of investigation it was found that pulchellus is available in the vicinity of Anjanapur and Madaga Tank in Shimoga and Chikmagalur Districts of Karnataka State. Pulchellus is found to be available in the river sanctuary of Sringeri mutt where the fishes were fed with flaked rice. The Sringeri fish sanctuary is rich with all age groups of this species. It is also available near Teerthahalli and NRpura of Chickmagalur District of Karnataka. Though it is reported that this species is available in Anjanapur, but, an investigation by the authors has shown that it is rarely available now in this area. It prefers less turbid water with more of dissolved Oxygen (> 6 ppm) as observed from the collection sites. The young fry and fingerlings ranging in sizes between 18-160mm were obtained from September to January in river Tungabhadra and in the vicinity of Anjanapur and Magada tank in Shimoga and Chikmagalur district of Karnataka.

Feeding habits: The gut content analysis revealed that pulchellus is essentially a herbivorous fish having preference for soft vegetation like *Vallisneria* and *Chara*. In India, Pulchellus is the only indigenous carp species, which feeds upon aquatic vegetation as well as submerged grasses. In the absence of grass leaves, this fish consumes grass roots and if this too becomes scarce, it feeds upon decaying vegetable matter and bottom debris. Although adults feed upon small sized gastropods, the fingerlings feed upon filamentous algae along with insects. One of the most remarkable features of the species is that, although vegetative, its gut length is hardly 3.0-3.7 times the total length of an adult. (David and Rahman, 1975).

TABLE 1 : Study of gonads of *P. pulchellus* collected from river Tunga during July to October, 1997

Month	*Average Fish Weight(g)*	*Average Ovary weight(g)*	*GSI (Gonad Somatic Index)*	*Average egg Diameter (mm)*
July	3,500	90	2.57	0.66-1.10
August	2,750	124	4.50	0.75-1.01
September	2200	120	5.45	0.63-0.99
October	1250	140	1.12	1.03-1.05

The value given in the Table is the average of 10.

A growth study using juvenile pulchellus (average wt.85g) was conducted in a cement cistern (10m^2 area) to confirm its feeding habits and growth. Twenty fishes were stocked in the cistern and were fed on chopped *Vallisneria ad libitum*. The growth of the fish after a period of 60 days was in the weight range of 150-200g (average wt. 170g) with a daily growth increment of 1.25g.

The fingerlings of pulchellus were found to be readily accepting common aquatic weeds such as *Lemna* sp. and *Hydrilla* sp. when fed at 25% of their body weight per day (Anon, 1990). Although this species is a good herbivore, its growth is somewhat slower when compared to the Indian major carps (Shanmukha and Kulkarni, 1985).

David and Rahman (1982) have reported that *P. pulchellus* is second only to the Chinese grass carp, *Ctenopharyngodon idella* and foremost amongst *Puntius* species that feed upon aquatic vegetation. Unlike any fish known, Pulchellus is the only fish consuming atleast submerged roots of water hyacinth, *Eichhornia crassipes*. Further experiments are needed to ascertain whether this species can be stocked in ponds partially infested with *Eichornia* as a measure for biocontrol of this weed.

The fish presents possibilities of being cultivated in irrigation canals in India where it can keep in check the growth of *Spirogyra* and *Vallisneria* as both juveniles and adults also feed upon filamentous algae (David and Rahman, 1975).

Sexual dimorphism : Males and females can easily be distinguished by the presence of prominent tubercles on snout and dark colour in the males, and smooth snout with silvery white colour in the females. In the breeding season, it is very easy to differentiate as the female has a bulging abdomen during this period. A brief study on the gonads is given in Table-1 which shows that the GSI increases from the month of July and reaches its peak in September and then declines.

Breeding season and habit: Pulchellus generally breeds from the month of July to November. Chakraborty (1998) has reported that the breeding season is an extended one and it lasts upto January. Another remarkable feature reported by David and Rahman (1975) is that, this species breeds in confined waters during post-monsoon months thus having the capability of perpetuating its own stock. The authors are of the view that while this fish does not breed in small confined waters, it may breed in large tanks, where riverine conditions are simulated due to the surface run-off of the rain waters, which induces this fish to breed. Experiments in this direction, if successful may help in counteracting heavy stock depletion and the present endangered status of this species.

Seed availability: The survey of water resources by the authors to locate areas of availability of seed of the species and

broodstock of the fish indicates that juveniles of this species are available from September onwards in the river stretches of Tunga from Sringeri to Gajanur (Shimoga) of Karnataka (Fig.1). Young fry and fingerlings (18-160mm) have been reported to be available from September to January in the vicinity of Magada tank, Anjanapur reservoir, Hutcheryanikere and Mighata tanks of Karnataka. Adult fishes ranging in size from 305 to 750 mm and weighing 0.30-6.0 kg are available in Tunga river system at Sharada mutt (Sringeri) and Ganesh temple at Bichaliguda near Teerthahalli. These two temple sites serve as the natural sanctuary for these endangered fishes.

Probable causes of decline in fishery

The most apparent causes for decline of this species are over-exploitation (over fishing) in late sixties, and also destruction of broodstock and juveniles. The submergence and silting of spawning grounds has reduced the spawning and recruitment success as observed in *P. dubius*, *C. cirrhosa* and *C. horai* (Kowtal, 1994). Reduction of lotic area, obstructions in breeding migrations and reduction in available spawing area have together caused the decline in breeding, recruitment and availability of *Puntius camaticus*, *Labeo kontius* and *P. pulchellus* in river Tungabhadra and river Cauvery.

A distressing factor common to all endangered fishes is the massacre of helpless broodfish congregations near dam sites and total destruction of juveniles by use of small meshed nets.

Reclamation of shore areas of lakes and rivers and over drawing of water for domestic and agricultural purposes have reduced the fish habitats and have added to the pollutant waters causing heavy stock depletion over a period of time.

Conservation strategies

The conservation measures needed include judicious exploitation of the fish stocks, artificial propagation and regular ranching programmes and also enforcement of mesh regulation and declaration of closed season during the breeding time. The protective measures include establishment of sanctuaries and protection of riverine pools. Shingeri (riverine pool) which serves as a natural sanctuary for pulchellus, should be extended and more of such areas should also be identified or if possible should be created for the effective conservation of this species.

Acknowledgement

The authors are highly thankful to Dr. S. Ayyappan, Director, Central Institute of Freshwater Aquaculture, Kausalyaganga, Bhubaneswar-2 for his constant encouragement and support for this study.

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Antibiotics from seaweeds

Australia's seaweed producers on the Pacific coast are reported to have welcomed the results of research which could well lead to the use of seaweed to develop a new class of antibiotics.

Dr. Diane McDouglad of University of New South Wales School of Microbiology and Immunology, is reported to have been awarded a grant of A$20,000 (US$ 10,100) for her discovery that some seaweeds use chemicals to stop bacteria from communicating and organising themselves to colonise seaweeds and interfere in their growth.

This finding has given the hope that it may be possible to use molecules similar to those found in the seaweeds to stop invading pathogenic bacteria from organising themselves inside the human body.

"Many species of bacteria that cause human infections use the same type of communications system that the seaweed-produced chemical can interrupt", Dr. McDouglad is reported to have said,adding "We are confident some of these mimicry tricks could be used to combat bacterial infections in people."

Clarias gariepinus in Punjab Waters

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The African sharp tooth catfish, *Clarias gariepinus* (generally referred to as Thai magur), comprising 20% of the total fish catch in Africa, is a remarkable and fascinating catfish species. It belongs to family Clariidae of order Siluriformes. *C.gariepinus* is extremely hardy and withstands adverse environmental conditions and habitat instability. Furthermore, it can efficiently assimilate a wide variety of both animal and plant protein. Another interesting aspect is its high fecundity. The sibling cannibalism noticed in this fish is the result of competition for food and cover and the extent of this cannibalism is shown to be density dependent under culture conditions. Growth under natural conditions, and particularly under controlled aquaculture conditions, is fast. It is hardy and does not easily succumb to diseases. This trait stems from its general ability to withstand wide environmental tolerance. It is a potential species for highly intensive culture without the prerequisite of pond aeration or high water exchange rates. This is because of its air breathing ability and tolerance to live in water of poor quality.

C.gariepinus has been translocated to several countries from Africa and is now farmed either in its native form or as a hybrid in several countries such as Republic of Korea, People's Republic of China, Taiwan, Philippines, Vietnam, Indonesia, Brazil, Poland, Hungary, Belgium, Holland, Bangladesh and India.

It is believed that the fish has made a surreptitious entry into India through Bangladesh. It is introduced into Punjab from West Bengal. In spite of the fact that the culture of *C.gariepinus* is banned by the government due to its highly predatory and cannibalistic nature, it is gaining popularity among fish farmers of Punjab as an economically viable alternative species to be cultured for diversification from carp culture system, now in vogue. Carps are not generally relished by the people of Punjab due to intramuscular bones. This tendency has resulted in an inviting stance towards Thai magur in the State. Major carps are cultured, principally because there is demand for them in Delhi, Calcutta and other centres. Major carps fetch low market price (Rs25-30/kg) within as well as outside Punjab compared to *C.gariepinus*. Moreover, the faster growth and relatively higher market price (Rs 50/kg) of this catfish has been luring the farmers to take up its culture. Some cautious and discerning farmers have taken to converting part of their carp culture ponds for the monoculture of *C.gariepinus*. The farmers purchase its seed at Rs 3-3.5/piece from local brokers who bring the same from West Bengal and they take 2-3 crops in a year. Now fish markets of Punjab are receiving supplies of *C.gariepinus*, and this has become disadvantageous to the marketing of carps thereat.

There are some risks associated with the translocation and culture of *C.gariepinus* beyond its natural range, as the species has all the qualities of an aggressive and successful invader, capable of adapting itself to living in new habitats. In South Africa, it has even colonized the Great Fish River through the Orange Fish Tunnel, as well as several river systems in Eastern and Western Cape Provinces, where they are now threatening populations of other indigenous species. Unfortunately, farmers are not aware of the highly adverse ecological implication of the proliferation of this fish, as it is highly predatory and cannibalistic in nature. Studies on larval rearing of this fish (indoor system) revealed that even four days old spawn starts chasing and injuring the others, causing 2-3% mortality per day. In West Bengal, fish farmers have already suffered a great loss and are ruined by the culture of this species. Further, its entry (may be accidental) into natural water resources of India may pose a serious threat to the indigenous fish.

Aquaculturists need to be much more sensitive to the danger posed by alien and translocated fish species, not only because they pose a direct threat to their industry by way of transfer of disease and parasites but mainly because of their negative effects on indigenous aquatic species and the possibility of hybridization and its effects on biodiversity. While aquaculture needs to be encouraged, this should not be done at the expense of biodiversity of the region. Although *C.gariepinus* has been translocated into several countries from Africa, the effect of these translocations has not been fully studied but it is believed that atleast in some of the countries the repercussions would be severe. The adverse impact is stated to be already conspicous in the southern states of the country.

Some of the farmers themselves, who had already cultured it, are advocating that its culture should be stopped. The reason for this is that, while the fish grows well,it does not generally command a commensuratingly good price. Due its highly cannibalistic habit, the yield also tends to be low. It is the duty of the extension officers to educate the farmers about the adverse consequences of culture of *C.gariepinus* and told that its culture would not fetch them incomes any better than carp culture in the long run. Further, they have to be educated on diversifying into to culture of export-oriented species such as giant freshwater prawn, Nile Tilpia and even tiger shrimps as a measure of profitable diversification. The fisheries department should help the farmers in obtaining seed of these species, while also establishing the needed infrastructure and organising subsidised supply of the seed of the species for a few years, keeping in view the possible higher incomes and inflow of foriegn exchange through exports, besides channelising supplies to local markets.

NFF supports demands of Andhra fishermen

Andhra fishermen are being deprived of Government subsidies and benefits extended to their counterparts in other maritime States, according to Mr. H.K. Debnath, Chairman of National Fishworkers Forum (NFF).

The NFF, which had thrown its weight behind the agitating A.P. fishermen, seeking subsidy on diesel oil, banning of fishing by foreign vessels off upper east coast, banning collection of wild shrimp seed and for substantial reduction or withdrawal or of the recent increase in port charges by Visakhapatnam harbour authorities, pointed out that while the fishing community in States like Maharashtra and Gujarat enjoyed excise duty and sales tax exemption on fuel, Andhra fishermen were denied this much needed assistance.

The NFF chairman, who visited the relay hunger-strike camp of the fishermen at Visakhapatnam on August 24, deplored that Andhra fishermen were also denied the 'relief-cum-saving' scheme being implemented jointly by the Centre and State Governments in other States. Under the scheme, according to him, fishermen contributed Rs.45 for eight months and were paid a matching amount by the Centre and State Governments during the four-month lean fishing season.

While traditional fishermen in other maritime States benefited from exclusive kerosene quota for outboard motors, no such scheme was offered in AP, he complained.

Referring to the 'abnormal' hike in berthing charges at the Visakhapatnam Fishing Harbour, he said that in other harbours in the country only a nominal fee was being collected. The NFF, he pointed out, was for abolition of berthing charges for fishing boats altogether.

The NFF chief said that Andhra fishermen were denied their legitimate share of benefits from the Centre because of the failure of the State Government to take up their cause. The entire fishing community in the country supported the demands of the agitating Andhra fishermen, he said.

Mr. Debnath, who is also the general secretary of World Forum of Fishery People (WFFP), said that the Indian fishing community would join the global strike by fishermen on November 21 opposing factory trawlers, industrial aquaculture and pollution.

Mr. Ch. Satyanarayana Murthy, general secretary of the Visakha Dolphin Boats Operators' Welfare Association, which is spreadheading the fishermen's agitation along with the AP Mechanised Boats Operators' Welfare Association, said that the outcome of the talks with the State Government and the Centre was awaited to decide the future course of action. While a delegation of fisher leaders to represent their problems to the State Government visited Hyderabad, another team visited Delhi to represent the same to the centre.

Thai Exporters want National Shrimp Plan

Shrimp farmers and exporters' associations in Thailand have called on their government to speedily implement a national policy encouraging shrimp farming to prepare for tougher export competation from neighbouring countries.

The associations also want their government to bolster exports by holding trade talks with new export markets such as China and South Korea.

This would compensate for the drop in Thai exports to the US market, which is looking at imports from western-hemisphere countries such as Panama, Ecuador, Honduras, Mexico, Nicaragua, Belize, Venezuela and Brazil - countries with a combined annual production of around 200,000 tonnes.

India and Bangladesh together produce 100,000 tonnes; Vietnam 50,000 to 70,000 tonnes; the Philippines 30,000 tonnes; and Malaysia 10,000 tonnes, it is stated.

World annual consumption of shrimp products is said to be 1.16 million tonnes. Between them the US, Canada, the European Union and Japan imported 1.02 million tonnes last year, with other Asian countries importing the bulk of the rest.

Bangladesh hosted Rural Aquaculture Training Course

A training course on Sustainable Rural Aquaculture for Small-Scale Farmers was held between October 7 to 25, 200 in Dhaka, Bangladesh.

It was organised by the International Institute of Rural Reconstruction (IIRR), in collaboration with the International Centre for Living Aquatic Resources Management (ICLARM), CARITAS-Bangladesh, CARE-Bangladesh, and Bangladesh Rural Reconstruction Association (BARRA).

The course covered broad issues/ modules, including: a) Understanding Issues Affecting Small-Scale Aquaculture; b)Managing Small - Scale Aquaculture projects; c)Participatory Approaches and Extension Strategies; d) Considerations in Planning Small-Scale Aquaculture Projects; and e) Plan of Action.

The three-week course was designed for development managers and planners, extension workers, and senior field staff.

Yadava as Member Secretary of Aquaculture Authority

Dr.Y.S. Yadava, IGO Cordinator, Bay of Bengal Programme of the Food and Agriculture Organisation, has taken charge as Member Secretary of Aquaculture Authority on 8.8.2001, with headquarters at Chennai. This is in addition to his present assignment as IGO Cordinator.

He replaces Mr.M.R.K.Nair,Fisheries Development Commissioner who has been the Member Secretary until Dr.Yadava took over.

Fish Culture in Borewell water Storage Ponds

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Borewells are one of the major sources of water for irrigating agricultural crops in Karnataka. Water from each irrigation borewell is invariably pumped into a pond, where the water is stored for a short duration, before being channelised to the fields. These ponds are constructed with the only aim of storing borewell water. Hence they are usually not deep. They are fully or partially bunded with earth, stone slabs or concrete. At present most of these ponds are not being utilized for fish culture.

The potentiality of these storage ponds for fish culture is surprisingly huge. For example, Kolar district alone has 19,569 irrigation borewells (1999-2000). Each borewell sustains a storage pond of 100 to 500 sq.m of area (one to five *guntas*). Assuming an average pond area of 150 sq. m, the total area of 20,000 storage ponds works out to 300 ha. Assuming utilisation of 50% of these ponds, an average yield of 1250 kg. of fish per hectare per year and a price of Rs.30 per kg. of fish, the total income works out to about Rs.56 lakhs! (the expenditure for fish culture in the storage tank is negligible). Hence these storage ponds are resources which cannot be neglected.

Farmers are not utilizing these ponds for fish culture because of three problems: 1) Ignorance about method of fish culture to be followed in these ponds. 2) Apprehension about poaching and 3) Non-availability of fish seed locally in numbers required. Problems one and two can be tackled by extension activities and modifications at the pond bed respectively. For tackling the third one, it is required to make the common carp fish seeds available, at all Taluk headquarters, in small numbers (50 to 250). Providing fish seed free of cost also deserves consideration, since the cost involved is very less compared to the production these ponds can give. For example, for stocking 10,000 storage ponds in Kolar district, the cost of common carp fish seed would only be around Rs.1.70 lakhs (taking average pond area at 150 sq.mt., stocking density at 50 common carp fingerlings per 100 sq. mt., cost at Rs.200 per 1000 nos of common carp fingerlings and Rs.2 as packaging cost per pack). This low level of investment would in turn generate an income of Rs.56.25 lakhs for the farmers of the district!

As an effort to try fish culture in these storage ponds, 16 of them were modified and fish culture undertaken in them, in the past two years by the Extension Education Unit, Hebbal, of the University of Agricultural sciences, Bangalore. This article outlines the success story.

Advantages of fish culture in Borewell-water storage-ponds

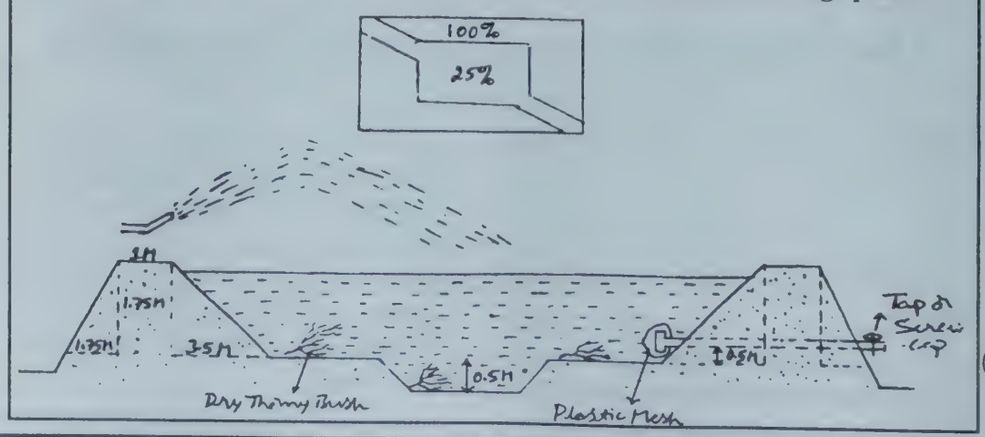
1. Weeds and algae do not grow in these ponds. Expenditure towards the elimination of these is thus avoided.
2. At negligible cost, the already existing resource is utilized, resulting in additional income.
3. The manure added gives rise to plankton and the feed given is fed upon by the fishes. The manured water helps in irrigating the adjacent land crop.
4. There are virtually no chances of the cultured fishes being infected by diseases. Thus, these fishes are very healthy for human consumption, as they are grown under complete organic farming conditions.
5. Grown up fishes can be caught in the required quantity at any time.

Method of Fish culture in Borewell water storage ponds

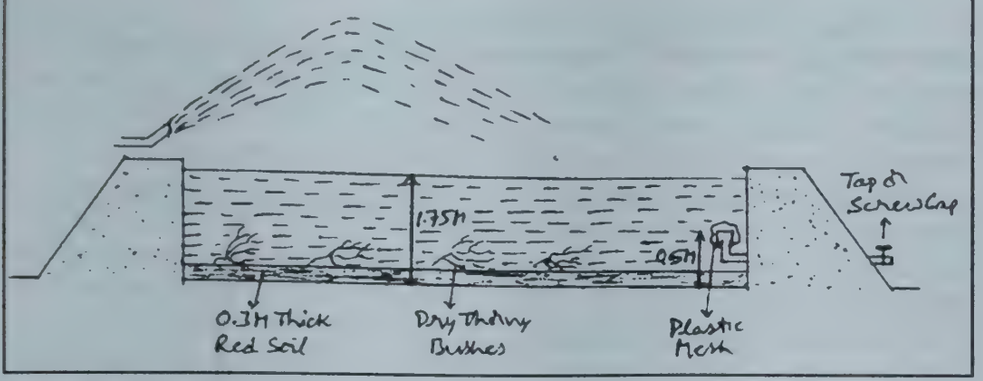
It is imperative to make a few modifications to these ponds for rendering them suitable for scientific fish culture. It is ideal to carry out these modifications in May/June, after few initial monsoon showers, when the land gets damp and the dependence on storage pond for other needs becomes minimal.

The pond may be dried for a few days first. The dried pond may be excavated and the soil may be piled up onto the bank, so that the height to the elevated top of the bank from the pond bed is 1.75 m. A Rescue/Harvest pit of the size equal to 25% of the pond area (*Eg*: 50 sq.mt. for a pond of 200 sq.mt. area), at the center/ outlet corner of the bed, may be dug thereafter. A diagonal channel of 0.5 mt

1. Modifications required for fully earthern borewell-water storage ponds:



II. Modifications required for borewell-water storage-ponds made up fully or partially of stone slabs or concrete



width and depth may be dug and the soil may be piled up on to the bank. The inner slope ratios of the pond and the rescue pit can be 1:2. The inner end of the outlet should be 0.5 m above the pond bed. This can be achieved by either deepening the pond or by fixing an upward bent extension of 0.5 m height to the inner end of the outlet. A short plastic pipe piece, of a diameter 1.5 to 2 times of the diameter of the outlet, may be fixed to the inner end of the outlet. A plastic mesh may be tied to this piece of pipe. The outer end of the outlet can be closed by using either a tap or a screw cap. Some hard and thorny bushes may be spread on the pond's bed including the rescue pit and the diagonal channel. An upward bend to the end of the borewell-water delivery pipe may be fixed so that the water goes up and falls down openly piercing through the air, thereby providing aeration.

Red soil may be spread to form 30 cm thick bed, if the pond's bottom is of stone slabs or concrete. (This may be done only after emplying the pond, in case there is accumulation of water). The inner end of the outlet should be 0.5 m above the pond bed. This can be achieved either by deepening the pond or by fixing an upward bent extension of 0.5 m height to the inner end of the outlet. A short plastic pipe piece, of a diameter 1.5 to 2 times the diameter of the outlet, may be fixed to the inner end of the outlet. A plastic mesh may be tied to this piece of pipe. The outer end of the outlet can be closed by using either a tap or a screw cap. Some hard and thorny bushes may be spread on the pond bed. An upward bend to the end of the borewell-water delivery pipe may be fixed, so that the water goes up and falls down through the air, thereby providing aeration.

After completion of the modifications, powdered burnt lime may be spread onto the pond bed at ten kg. per 100 sq.mt After 15 days, farmyard manure may be spread on the pond bed (excluding the rescue pit) at the rate of 50 kg. per 100 sq.m. Ten days later, common carp fingerlings at the rate of 50 nos per 100 sq.m may be released.

Cattle/Poultry/Pig/Silkworm dung, biogas slurry, ragi balls, rice bran, kitchen wastes, dead silkworms, other farm by-products/wastes/leftovers can be given as feed for fishes. Farmers can also go one step ahead while promoting fish culture, when they can afford, to feed fishes with formulated pellets for faster growth. In fact, pelleted cattle feed locally available can also be used as supplementary feed. Formulations using the locally available by-products or cheap ingredients can also be developed. Feeds or manures should not be put into the rescue pit. If the water colour turns to dark green, feeding and manuring should be stopped immediately, till the colour turns back to light green. When the water level is too low, manuring/feeding has to be avoided. Temptation to walk around in the pond also has to be avoided. If algae or weeds appear in the pond, they have to be removed completely at once. As far as possible, efforts should be made to keep the water level to the maximum. Near-complete refilling of the pond during evening hours should be avoided, as far as possible. It is desirable to rear a few ducks which move around on pond's water during the day and take shelter in a shed during night.

Depending upon pond fertility, quality of fish seed, feed and manures being used and other culture practices, each of the fishes can attain an average weight of about 0.75 kg. in ten months in these ponds. After ten months, few leafy branches can be put into the pond to induce the common carp fishes to breed. After the young ones grow to the size of fingerlings, the water level may be reduced and the thorny bushes at the bottom can be removed, before harvesting the grown up fishes. The fish fingerlings can be held in a large net immersed in water or stored in a big container for few hours, during which time the mud at the pond bed can be collected for using it as a manure for land crops. Thereafter fingerlings can be released at the rate of 50 nos. only per 100 sq.m of pond area to continue the culture. It is desirable to buy and release fresh stock of fish seed once in two years.

Future Possibilities

It may be possible to export ornamental fishes from Devanahalli International Airport which is expected to come into existence soon. Once this happens, the borewell-water storage-ponds could be used either to culture ornamental fishes to adulthood or to the sizes demanded by the market. Sterile varieties of fish now being tested for increased flesh yield may boost production from those ponds. Development of cheap supplementary floating feeds will increase the fish yield from these storage ponds. When seed of air breathing fishes (not the banned African catfish) become easily available, potentiality of these ponds could be fully utilized. Establishment of a system of selling the common carp fingerlings produced in the storage ponds can make fish culture in these ponds more attractive, besides reducing the scarcity of common carp fish seed in the State.

Jharkhand Newsletter

From A.K. Singh

Advisory committee for Fisheries Development in Jharkhand State

An advisory committee has been constituted for evaluation of the fisheries development programmes on-going in Jharkhand state by the Department of Fisheries and to recommend such measures as are necessary for reorienting them. The Committee was also asked suggest the area of research work and technologies to be adopted for utilising the resources effectively in a sustainable manner. The Committee members are;

1. Secretary, Animal Husbandry & Fisheries Dept, Jarkhand: Chairman.
2. Regional Director of Fisheries Ranchi - Member-Secretary.
3. Director, CIFA Bhubaneswar or his nominee, - Member.
4. Director, CICFRI, Barrackpore or his nominee, - Member.
5. Nominee of Birsa Agricultural University, Ranchi - Member.
6. Nominee of Rajendra Agricultural University, Samastipur - Member.
7. Representative of Fisheries Division of Ministry of Agriculture - Member.

Fishermen's Day Celebrated

Fishermen's Day was celebrated in Doranda fish farm, Ranchi. About 100 fish culturists and fishermen participated in the programme. Mr. P.K. Jajoriya, Secretary, Animal Husbandry and Fisheries spoke on the different programmes of the State Government for fisheries development. Mr. Rajeev Kumar, Regional Deputy Director of Fisheries, explained the ongoing programmes of Fisheries department. Mr.Ashish Kumar, District Fisheries Officer, Ranchi explained the importance of the day. Dr.K.P. Singh, Grameen Vikas Trust, narrated the success story of fish culture under his project. Mr.V.P. Srivastava, Assistant Director of Fisheries (Research) explained the importance of Soil & Water analysis in fish culture ponds and facilities available in this context in the department. Dr.A.K. Singh, Birsa Agriculture University, explained the techniques to adopted for achieving successful rural Aquaculture. One of the farmers explained the difficulties faced by the farmers in undertaking successful fish culture. Later, the ueries of farmers in respect of the problems encountered by them were answered by the technical officers.

Carp hatchery started functioning in Dorand fish farm

A Circular Carp hatchery has been constructed in Dorand fish farm last year, funded by DRDA, Ranchi. This season the hatchery has started working upto 10th July and about 3 million spawn of Common Carp & Indian Major Carps has been produced. The distribution of fish seed was started on 'Special Fish Farmers Day' i.e., 10-07-2001.

The target of FFDA Ranchi is to produce and distribute 10 million fingerlings for this year. As part of the effort in this direction, spawn of Indian major carps has also been collected by the farm staff from river 'Sone'. The spawn has been stocked for rearing in the nursery ponds. The spawn has been also stocked in other farms i.e., Salimar, Hatia, Mahespur. Similarly fish seed distribution has also been taken up from Chandwa, Daltanganj, farms of Palamu district, Gumla and Simdega farm of Gumla district and Nadia farm of Lohardaga district.

Fishermen's Housing Scheme

Under Fishermen's Housing Scheme, supported by the Government of India, 55 Houses and three tube wells have been completed in Bundu village of Ranchi district. 100 houses and four tube wells at Daltanganj and Chaibasa and Dumka are proposed for construction.

Hatchery in Palamu and Dumka Dists. proposed

Carp hatchery construction has been proposed for Palamu district and Dumka district. Renovation of existing hatchery at Salimar is also to be taken up. A prawn hatchery is proposed in Tatanagar.

New proposals for 2001-2002

Pond Constrution: A proposal with an outlay of Rs.40.00 lakhs has been submitted for the construction of 75 ponds in the private sector, with each pond having a water area of 0.30 ha. The farmers will be supplied with the inputs for fish culture by the authorities.

Fisheries Research: A proposal has been submitted to the Government for undertaking Research on Induced breeding of Indian magur (*Clarias batrachus*) and to conduct experiments on viable on prawn farming.

Sri Lankan Shrimp Farms abandoned

Thousands of shrimp farms in Puttalam district of Sri Lanka have been abandoned as a result of the rise in ammonia level of the water in both Mundal Lagoon and Dutch Canal, according to Prawn Farmers' Exporters Association secretary David Edirisinghe, it is reported in *Fish Farming International*.

The report says: When the water level in the Mundal Lagoon dropped in November and December, decomposed material which would otherwise be carried to the sea accumulated. As a result the water had become so contaminated that it became toxic.

Edirisinghe also claimed that the authorities had failed to monitor the guidelines set by the Ministry of Fisheries for prawn farmers.

It is stated that, although certain guidelines were set by the Fisheries Ministry for the farmers to adhere to, the authorities did not supervise the farming activities and improper methods by small scale farmers had resulted in increase in ammonia content. However, NARA's Inland Aquatic Resources Division chief, P.P. Siriwardane, said that research had shown that the ammonia content was at a permissible level.

Orissa NewsLetter

From H.S. Badapanda

Integrated Policy for Ports Development

It has been resolved in a cabinet meeting of Orissa Government to take up for consideration an integrated privatisation policy for ports development. As a follow-up to this decision, it was proposed to prepare a master plan. A secretariat level committee under the chairmanship of the Chief Secretary, Orissa would submit a feasibility report to the cabinet on the subject, in the first instance, within a month. It was felt that there was possibility of developing ports at Bahuda estuary of Ganjam Dist. Baliharachandi and Astarang of Puri district; Dhamra and Chudamani of Bhadrak district; Inchudi, Chandipur, Subarnarekha, Bahabalpur in Balasore district and Jatadhar estuary in the district of Jagatsinghpur. The Chief Secretary Mr. D.P. Bagchi said that such an initiative along the 480 km long coastline of Orissa would definitely promote economic development of the State. It was envisaged that the State Government would provide local facilities and the private companies would make capital investment for an all out development of such ports. It was indicated that after the Gopalpur port project was handed over to M/s. Adani Exports Ltd. the Port's development has been significant.

Fixing 'TED' made compulsory

Mr. Naveen Pattnaik, Chief Minister, Orissa announced that fixation of TED (Turtle Excluder Device) in all nets operated from mechanised boats in the coastal waters of the State had been made compulsory. The Chief Minister made this announcement on 10 April 2001, when he attended as Chief Guest in the concluding session of a seminar held at Hotel Swosti jointly sponsored by the Deptt. of Forest and the Indian Wild Institute.

The Chief Minister indicated that the Govt. of Orissa had already taken steps to declare three important areas, i.e., from Dhamara to Barunei estuary, from Jatadhar to Devi river estuary and from Magarmukh Chilka to Rusikulya estuary as restricted zones for fishing. This work was being regularly watched by the Indian coast Guard and the Deptt. of Forest, he said. In addition, the Gahirimatha coast had been declared as a wild life sanctuary, he indicated.

Mr. A.S. Sarangi, Secretary, Deptt. of Forest, Orissa and Mr. S.K. Mookherjee, Director, Indian Wild Life Institute, Dehradun, also adressed the seminar while Mr. S.K. Pattnaik, Chief Warden, proposed a vote of thanks.

Appeal for Restricted Fishing

Mr. Biswajeet Mohanty, on behalf of the Orissa Wild Life Committee has appealed to the Govt. of Orissa to declare closed season for fishing operations in rivers, estuaries, canals, and reservoirs from June 15 to August 15 every year by a notification, as this period happened to be the breeding season for fishes. Large scale migration of fishes had been observed in Mahanadi, Brahamani, Rusikulya, Subarnarekha and other rivers during this period and therefore such a step would facilitate the fishes to lay eggs and this would lead to increase of fish population in the rivers, he added. It was stated that such a proposal was also submitted earlier to the State Government to restrict fishing in the Chilka mouth and coastal waters during the breeding season. These appeals need to be considered by Government for ensuring more of fish production in the State.

In the meantime, Mr. B. Harichandan, Minister for Fisheries and ARD Deptt. Orissa indicated that for economic development of rural people and to increase self-employment of unemployed youth it was vital to create a situation for production of more fish, milk, meat and poultry. The Minister said that the present level of fish production in the State was only 2.70 lakh mt. which was low compared to the resources available for both freshwater and brackishwater sectors. The percentage of utilisation was limited to below 50%. He emphasised the need to double this level of production within next three years. The minister regretted that the per capita annual consumption of fish in the state was only 7 kg. In this connection, he laid focus on the need to bring more of waterspread area under culture in years to come.

Task Force for Promotion of Shrimp Farming

Mr. D.P. Bagchi, Chief Secretary, Govt. of Orissa announced in a Seminar held in Bhubaneswar on 29 May, 2001 that a special task force would be constituted for promoting both shrimp and prawn culture in the State. He indicated that the task force would examine the feasibility of clearing 1500 applications received from shrimp farmers, keeping in view the provisions of CRZ and directives of the Supreme Court of India. He had also suggested the formation of an Advisory Committee to help the Director of Fisheries, Orissa, to promote freshwater prawn culture in the State, while also reviewing the progress once in every three months. The Chief Secretary was addressing the participants at the Seminar conducted by MPEDA. Among others who addressed and participated in the Seminar were Mr. K. Jose Cysiac, Chairman, MPEDA, Mr. J.N. Panda RDC (SD) Berhampur, Mr. Sanjay Mohanty, Chairman, OSFA, and Mr. G.K. Dhal, Director of Fisheries, Orissa. Mr. S.K. Sahu and Mr. A.K. Samantray, Dy. Directors of Fisheries. also participated. Mr. Prabhat Samantray, M.P. and Authority Member of MPEDA presided over the seminar. Mr. Santhana Krishnan, Jt. Director MPEDA, proposed a vote of thanks. The deliberations at the seminar would be published in *Fishing Chimes*.

Shrimp Farming

The other story : Large scale transportation of berried *Penaeus monodon* from

the coastal belt of Orissa has caused concern both for the fisheries officers and police personnel of the State. This is being done regularly by vested interests. Recently from Paradeep fishing base 39 such gravid females were caught by the Assistant Director of Fisheries (Marine) Paradeep, valued at about Rs.4 lakhs. Such activities are reported from coastal pockets like Balikuda, Kujang, and Ersama. These are creating discontentment among the coastal communities who fear that by such activities the shrimp catch in both inshore and offshore region would fall drastically below the expected level. Though as per OMFRA the fishing by mechanical boats inside the inshore region has been fully banned, there is no proper patrolling to prevent such operations in coastal waters. In addition to this menace, shrimp juveniles are collected in millions by local inhabitants for supply to shrimp culturists through their agents. Unless both these activities are checked the population of shrimp would dwindle down.

There are reports that by promoting shrimp culture invaluable mangrove forest area is destroyed because of excavation of shrimp farms. The Orissa Wildlife Society has indicated that, for promoting shrimp culture in one hectare of waterspread area, a natural biosphere of about 160 ha. is required. Moreover, to protect the coastal belt from cyclone and submergence of agriculture fields the existence of mangrove forest is a dire need. The society, giving the example of Thailand where such culture has brought acute misery to the coastal people has warned not to go in for intensive/semi-intensive shrimp culture. It has advocated traditional culture practices.

News in Brief

1) Strike called off : Responding to a call from the National Fish workers Manch and the Orissa Traditional Fish Workers union embarked on a dharna accompanied by a demonstration before the Collectorate of Ganjam District since 12/7/2001. The demands consisted of 10 points out of which the important ones were to supply drinking water to all fishing villages, imposition of restriction on the collection of both shrimp juveniles and berried females from coastal waters, seizure of unauthorised trawlers operating against OMFRA etc. It is learnt that the strike has been called off on 15/7/2001 after receiving a fax message from Govt. of India. The Union has however resolved to resort to agitate again as they are unhappy at the inaction of the State Govt. to fulfill their demands.

2) Agitation for construction of Ghery: It has been reported that in Nuagada, Jhadlingi, Sahan, Sudhikashwar, Chhuriana, Anakela, Nampur, Astaranga, Natra, and Karala area of Astaranga, hundreds of acres of agricultural land has been converted into shrimp farms and that canals for providing sea water are being dug on Govt. land to help shrimp farming. The situation has been reported to be tense and may lead to law and order problem at any time. It has been appealed to Government to stop unauthorised construction of such canals.

3) Reservoir Fishery leases Demanded: Leasing of Sandhei, Taradia, Baumsagada, Ostapura, Sunaghai, Angarua, Madanpur, and Padampur reservoirs located in Anandpur Sub-Division of Keonjhar District has been sought in order to avoid clashes between fishermen and public. It is stated that this would not only yield additional revenue to Government but would also promote systematic fish culture in these water bodies.

CMFRI bags Consultancy Project in Sharjah

The Central Marine Fisheries Research Institute, Cochin has bagged a consultancy project in Sharjah, UAE, for setting up a marine pearl nucleus implantation - demonstration unit, captive holding of nucleated and non-nucleated pearl oysters and a pearl jewellary sales outlet in Sharjah, with the collaboration of the Department of Commerce and Tourism and the Sharjah Airport International Free Zone (SAIF-Zone). The Director of CMFRI Dr. Mohan Joshep Modayil and Head of Molluscan Division Dr. Appukuttan have just returned from Sharjah after clinching the deal with the government authorities in Sharjah. The project is expected to be completed in one year and will involve visits of three batches of scientists from CMFRI to undertake commissioning of the facility in the Al-Jazeera Park area in Khalid Lagoon in Sharjah. The team discussed the proposal with Sheik Tariq Al-Qassemi, the Chairman and Sheik Saqer R.H.Al-Qassemi. The Deputy Director General of SAIF-Zone and finalized the future plans. The proposed facility will come up in a newly constructed 20,000 square feet building which will also host a maritime museum and information center. The team also called on the Indian Consul General in Dubai Mr. Ashok Mukherjee who has promised all help in taking the project to completion in the shortest possible time.

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